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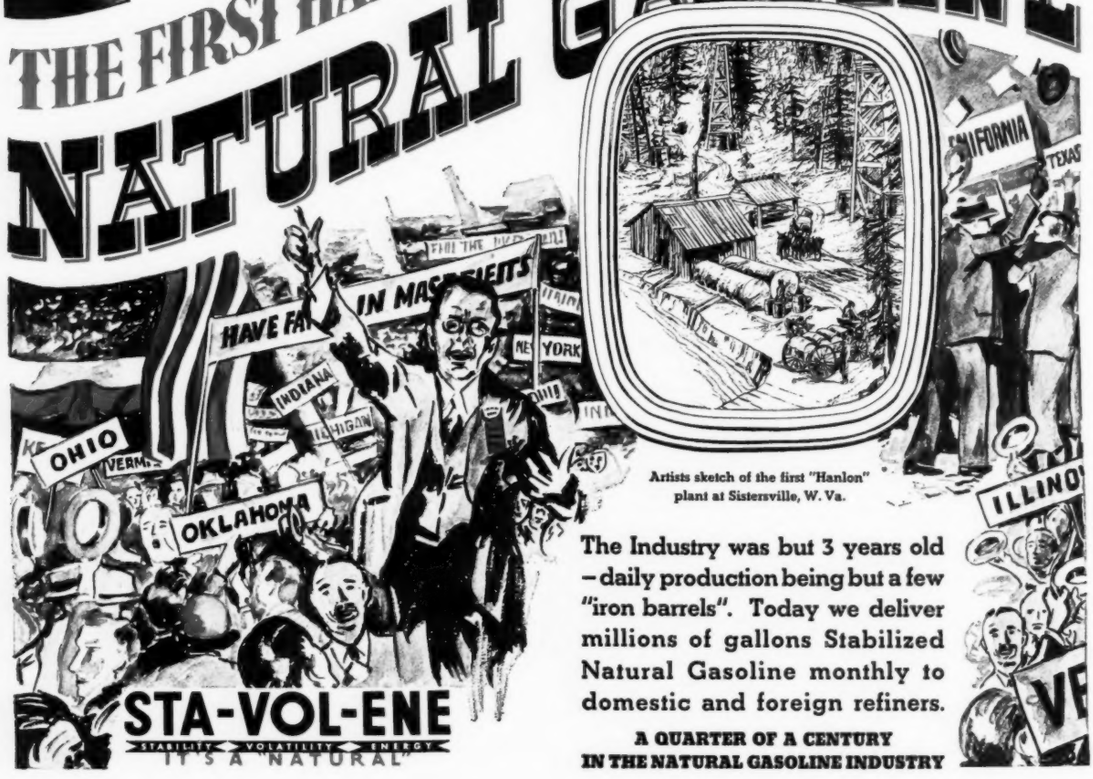

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PETROLEUM

Campaign Issue

IF THE Roosevelt Administration had the courage of its convictions it would make its campaign for reelection upon the issue of a change in the American system of government, including the abolition or subordination of the existing powers of the Supreme Court and concentration of authority in the hands of the Chief Executive. It is safe to say, however, that the campaign will not be fought upon this line if the President and his advisers can avoid it. It is rather to be expected that they will continue to seek by indirection what they are forbidden to do directly, to propose legislative measures that are not what they seem and to attempt by divers means to establish a system of state socialism under the guise of benefiting the poor and the weak, although actually the effect would be to make the poor more poverty-stricken and the weak more dependent upon government bounty.

If the people of the forty-eight States comprising the American Union desire to have their industries controlled by a group of governmental bureaus in Washington, to see Congress abrogate its proper authority, to place in the hands of a single individual the power to redistribute wealth and to incur a monumental indebtedness; to determine by a word whether the value of their homes, their savings and the money in their pockets shall be one thing today and a totally different thing tomorrow; then the present is the time when that decision should be registered. Stripped to essentials this is the real issue of the approaching presidential campaign. Unfortunately the fundamental objective of the Administration is likely to be so bedecked in the glittering tinsel of alluring promises and to be presented with such seductive words that its Mephistophelean form and purpose will not be recognizable.

▼

Guffey Decision

UPON the rubbish heap where lie the whitening bones of NRA and AAA and other New Deal measures the Supreme Court has now deposited the Guffey Coal law, conceived and enacted in defiance of earlier decisions. Erasure of this law from the statute books is a development of particular significance to the oil industry for it was openly averred in Washington that if sustained it would serve as a model for a regulatory measure to be applied to petroleum.

That the Roosevelt Administration is still determined to place the oil industry under federal control is beyond question. This is merely part of the unfinished business postponed until after Election Day. That it is prepared to resort to punitive legislation to bring the industry into voluntary or involuntary acceptance of its program is hardly a secret. The only obstacle is the Supreme Court but the proponents of bureaucratic control of industry do not despair of evading the rulings of that tribunal or even of bringing it into subjection.

Until that time comes, if unhappily it ever does, it would seem that the Guffey case decision will render difficult, if not impossible, the achievement of that complete mastery over all branches of the oil industry which the Washington apostles consider desirable. If coal mining is a state affair so equally is the production of oil. Congress may regulate interstate traffic in either commodity but the Court has held that it cannot control output through imposition of a penalty in guise of a tax. The two resemble each other so closely that regulation forbidden to one clearly cannot be applied to the other. Both have bred conditions that need remedying but the remedy does not lie in turning them over bodily to the dictation of federal authority.

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Danger Signals

NEVERTHELESS the oil industry cannot afford to neglect any steps that it is able to take toward keeping its own house in order. Between the form of control that was attempted in the coal industry and the present system of relative freedom for private initiative still preserved for oil there is a wide area for federal interference and regimentation. Another period of over-production and waste such as attended the early history of East Texas would provide a powerful argument for those who hold that neither private enterprise nor the States themselves are capable of self-regulation.

Numerous danger signals have been flying for the past few months. Crude production reached a record level during May, rising to more than 3,000,000 barrels daily for part of the month and topping the high level of 1929. Motor fuel stocks have been built up to unwieldy proportions and the expected gain in consumption has not yet been able to reduce them to seasonable dimensions. Mounting production in the Rodessa field has again raised the spectre of market demoralization.

While producers have been talking about an advance in crude prices events have been shaping themselves to make a cut in these prices seem more within the range of probability.

That the leaders of the industry are alive to the danger in this situation is shown by the warnings uttered by President Byles of the American Petroleum Institute and others and by the efforts being made to hold the Rodessa output within bounds and to prevent its disruption of the interstate compact.

Constant danger to the stability of the crude oil situation exists in the possibility that flush production from some new field may upset the balance between supply and demand. Every fresh development of this kind brings new producers into the industry. The enthusiasm of these producers who have little background of experience in the oil business makes them impatient of restraint upon the exploitation of their new found wealth. Where state laws are inadequate or laxly enforced the danger of spreading a demoralizing influence is increased. Strengthening of weak laws and education of lease owners and operators to the fact that through excessive production with consequent low prices they are robbing themselves as well as all other producers is an ever present necessity.

The oil industry is and will remain constantly on trial as to its ability to conduct its operations soundly. Any dereliction in its efforts to demonstrate that ability is a direct contribution of ammunition to its critics and enemies.

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Alcohol as Motor Fuel

With the support of the Farm Chemurgic Council and the solid backing of the Chemical Foundation the movement for the utilization of alcohol as a motor fuel in the United States has become one that the petroleum industry cannot afford to ignore. The men who are enlisted in this movement are not mere theorists and dreamers. They are practical men and they are going about the accomplishment of their purpose in a thoroughly practical way. In their own attitude toward the subject the members of the oil industry would do well to show equal intelligence.

To oppose investigation and experimentation looking to the development of motor fuels from sources other than petroleum is futile. While we do not subscribe to the belief that the petroleum resources of the country will be entirely exhausted in fifteen years, or in fifty, the fact remains that oil is an exhaustible natural resource and that the time will come, even without the complete drainage of underground supplies, when other methods of providing liquid fuel must be brought into play.

Oil companies themselves are not blind to this situation. They are prepared to undertake the development of the vast shale deposits of the country and to introduce the hydrogenation of coal or other methods of maintaining the liquid fuel supply whenever it becomes economically practicable to do so. If, meanwhile, it is proved possible to produce a cheap and efficient motor fuel from corn, cane, wood wastes or other available sources, the oil industry, as a purveyor of liquid fuel to the public, should welcome it and be prepared to aid in its distribution.

To the enterprise in which the Chemical Foundation is now engaged—that of equipping a plant in which the possibilities of alcohol production from various farm products can be tested and where the costs of such production can be determined accurately—there can be no objection. Such an undertaking serves a useful purpose by determining the feasibility and the relative economy of fuel production from this class of material.

Objection may very properly be made, however, both by the oil industry and by the users of liquid fuel, to any attempt through the exercise of governmental authority to compel the use of a costly and inefficient substitute for gasoline. Such action would amount to taking wealth from one group of citizens to hand it over to another special class. Being now the most seriously tax-ridden business in the country the oil industry certainly has the right to oppose the placing of further penalties upon its operations.

Furthermore, as the experience of other countries has shown, the economic loss involved in any such program far outweighs the limited advantages conferred on a handful of the total population. In the United States, where the farmers themselves consume a large proportion of the motor fuel used, they might find themselves out of pocket on the whole transaction. In the present relationship of costs they might be better off to burn their excess corn in their own household furnaces rather than to go through the costly procedure of processing, treating and transporting its product, and to pay for the privilege of burning it in their motor vehicles.

It is reasonable to assume that in time to come the price of gasoline will rise materially above its present level. It would be foolish to assert that the production of alcohol cannot be cheapened. To prepare for the time when the two curves may meet is a sound policy. To attempt forcing the premature use of one form of fuel at the expense of the other would be not merely uneconomic but, in all probability, futile.

▼

Cold Douche for Tariff

Hopes of those who advocate a higher tariff against oil entering the United States, already somewhat shaken by the legislative jam in Congress, were dashed by the letter which Secretary of State Hull addressed to the chairman of the House Ways and Means Committee early in May. The subject of the Secretary's letter was the Disney bill which proposed to double the tax on imported crude and fuel oil, to place a duty of $2 per ton on asphalt and to remove the tax exemption hitherto accorded to oil supplied to vessels fueling in American ports.

"In general the advisability may be questioned of imposing or increasing protective duties upon commodities the imports of which are small in relation to domestic production", the Secretary wrote. "Such action seems even more questionable in cases in which exports considerably exceed imports. The interests of the domestic petroleum industry in export markets clearly exceed their interests in the portion of the domestic market which may be filled by imports. Exclusion or reduction of imports into the United States by means of increased taxes or quotas is not likely to cause a directly proportionate decrease in the amount of crude petroleum produced and refined in the countries of origin. It is very likely that this production, if even more completely excluded than at present from competition with American petroleum products in the United States, will be offered for sale in outside markets and increase the existing competition with American exports in those markets."

After explaining that enactment of the bill would handicap the efforts of the government to extend its reciprocal trade agreements and might result in retaliatory quotas against American products, the Secretary proceeded to demolish the proposal to tax bunkering oils. He revealed that protests against this section of the bill had been received from the French and Netherlands governments and added that since the greater part of all imports come directly or indirectly from Venezuela, adoption of legislation directed largely against this one country might have "unfortunate effects" upon United States commerce with Venezuela. Aside from these considerations, this particular legislation would be a violation of treaty engagements and the Secretary observed with a bit of fine cut irony, "I assume that your Committee would not desire to recommend any legislation in conflict with our treaty obligations".

New Company for International Field

Would Combine Marketing Facilities of Texas Company and the Producing and Refining Activities of Standard of California in Near and Far East, Constituting Fully Integrated Unit.

SAN FRANCISCO, JUNE 1

NEGOTIATIONS under way here, which are so far advanced as to be almost certain of successful conclusion, contemplate a new and important set-up in the field of international oil trade. The proposal now being considered looks to the organization of a new company which will be jointly owned by Standard Oil Company of California and The Texas Corporation, and will take over the present holdings and operations of both parent organizations in the entire area east of Suez.

In that part of the world Standard of California, as is well known, within the past few years has developed important production in the Bahrein Islands, located in the Persian Gulf, and holds a concession covering another promising field in eastern Saudi Arabia. Through the Netherland Pacific Petroleum Co. (N.V. Nederlandsche Pacific Petroleum Maatschappij) Standard Oil Company of California recently has been negotiating a concession of approximately 1,500,000 acres in northwestern Sumatra. The company holds a 20 percent interest also in conjunction with the Royal Dutch-Shell Group and Standard-Vacuum Oil Company in a concession of the Netherlands New Guinea Petroleum Company (N.V. Nederlandsche Nieuw-Guinee Petroleum Maatschappij) covering 10,000,000 acres in New Guinea. This area is to be reduced to 1,000,000 acres within ten years or earlier when the company has completed its preliminary work.

At the present time the New Guinea concession is under survey and its possibilities in the way of oil production are quite unknown. The one field in the Near and Far East in which Standard of California has established production is Bahrein where it has twenty-six producing wells. The latest of these (well No. 31) was brought in about the middle of May flowing 26,880 bbl. per day at 2,273 ft. A previous well (well No. 26) was brought in April 29 with 20,400 bbl. per day. These are the largest of the Bahrein wells and indicate that the field exceeds earlier expectations. While production is being held down, the Bahrein Petroleum Company during 1935 sold and delivered 1,265,000 bbl. of Bahrein crude and has commitments for shipments of approximately 10,000 bbl. daily during 1936.

Last year the company started construction of a refinery at Bahrein which is now nearing completion and which will utilize an additional 10,000 bbl. daily. With this output Bahrein takes its place this year among the important oil producing areas of the world.

In the past Standard Oil Co. of California has not attempted to develop local distribution facilities in Asia or Oceania but has sold oil and products to various other distributors. With the development of a quantity output from its Bahrein properties, however, and the prospect of further increases in production, the question of finding a settled output for this oil and disposing of it without upsetting the stability of existing marketing arrangements becomes one of serious moment. During the latter part of last year a series of conferences took place between representatives of California Standard and a group representing Royal Dutch-Shell, Jersey Standard and Anglo-Iranian. Discussions at that time concerned joint action by the three latter to take over the holdings of Standard of California in Bahrein or to take the output of Bahrein wells. No agreement was reached and it was subsequently that negotiations were opened between Standard of California and The Texas Corporation.

The facilities of the two companies in Asia and Oceania naturally complement each other. While Standard of California has production without established marketing outlets, Texas Company has distributing facilities in practically all parts of the Far East and has long been a substantial factor in the trade of that part of the world. The red star emblem of the company is familiar to purchasers of petroleum products in Japan, China, India, Indo-China, the East Indies, the Philippines, Australia and New Zealand. The products disposed of through stations maintained in these countries had to be drawn from distant sources of supply. Inasmuch as The Texas Company has been regularly a purchaser of crude to meet its distribution requirements, the advantage of having a connection with nearer sources of supply was obvious. It is as an outgrowth of this situation that the proposed combination of interests came into consideration.

The projected arrangement is very similar to that followed by Standard Oil Company (New Jersey) and Socony-Vacuum in organizing the Standard-Vacuum Company in which were combined the producing interests of the former and the marketing facilities of the latter. As in that case the union of interests between California Standard and Texas will apply only to operations in the Trans-Pacific and Near Eastern areas and will not affect the activities of either of the parent companies in other parts of the world.

In international oil circles the projected organization is looked upon with favor as providing assurance that oil from Bahrein and other potential fields under the control of the proposed company will not become an upsetting factor in international markets.

Camp of Bahrein Petroleum Co. and its first well, Jebel Dukhan No. 1, Bahrein Islands.

Alcohol Motor Fuel—the Case Pro and Con

Higher Cost of Alcohol Makes Open Competition of Blends with Pure Gasoline Impossible—Larger Consumption Required Because of Alcohol's Lower Heat Value

SOME twenty-two governments, some of them dependencies, by legislation or by tax differentials, encourage or require the mixture of alcohol with gasoline for motor fuel. Among these are fourteen countries of the first rank. With a single exception, these are countries that do not produce petroleum or whose petroleum resources are so limited that large yearly importations are required. Alcohol can be made in any part of the world from a number of native products, but nowhere, up to the present time, can alcohol suitable for an internal combustion engine be produced at a cost low enough to compete on equal terms with gasoline. State aid or the exercise of state authority is necessary to bring it into general use.

Arguments used to support the compulsory requirement of alcohol-gasoline motor fuel are chiefly three in number. It is contended that by using indigenous products to supply part, at least, of a nation's motor fuel requirements, dependence upon importations is reduced and the national security in time of war is enhanced. In this era of intense nationalism there is assumed to be some virtue in producing everything at home, no matter how great the cost. The nationalistic argument and the security argument go hand in hand.

In the past few years, since many nations have abandoned their historic monetary standards and exchange difficulties have multiplied, a second reason for insisting upon including domestically produced alcohol in motor fuel is that it decreases the amount of money or products that must be sent abroad to pay for imported petroleum or petroleum products. Since the total tonnage of the alcohol-gasoline mixture required is greater than would be the case with straight gasoline, this advantage is less than appears on the surface but it is a consideration that undoubtedly has carried weight with the governments of certain countries.

More weighty than either of the foregoing, however, in promoting legislation to make compulsory the use of alcohol in motor fuel has been the desire to help the farmer. In every country where such legislation has been enacted the benefit to agriculture has been the chief claim advanced by its proponents, and this is now the basis of agitation for requiring the use of alcohol in countries like the United States, which have no present lack of petroleum and where arguments based on national security or self-sufficiency do not apply. It is as a measure of agricultural relief that the soundness or unsoundness of the movement to compel motorists to use a mixture that they would not adopt solely on its own merits must be judged.

Much heat has been generated in the discussion of the merits and demerits of alcohol fuel and some extreme claims have been made on both sides of the question. Without going into technical phases of the subject certain facts appear to be generally admitted. It is perfectly possible to fuel an internal combustion engine with alcohol or with a combination of alcohol and gasoline. Since the heat value of alcohol is less than that of gasoline, the consumption required to perform an equal amount of work is greater with an alcohol-gasoline mixture than with pure gasoline. Numerous tests have indicated that the difference in the case of a fuel containing 10 percent of alcohol is from 4.5 to 5 percent.

Experience in countries where the use of mixed fuel is required seems to indicate that vapor lock is more likely to occur where such fuel is used and that in motor car operation alcohol is more likely than gasoline to carry sediment from the fuel tank into the feed lines. As is well known, water will cause the separation of alcohol from a mixed fuel. While the presence of water can be guarded against ordinarily, there is always the possibility of contamination from this source. In airplane engines the use of alcohol is not required even in countries where its employment in land vehicles is compulsory, the reason being that a small amount of water, probably from condensation, often is present in airplane fuel tanks.

Care must be used, in introducing alcohol into a car, not to leave any of it on the outside body as it will leave spots or remove the paint. Complaint has been made in some cases that it apparently causes the rapid deterioration of hose connections. These, of course, are minor objections that can be overcome by care in operation and by adapting motor vehicles to the special requirements of alcohol fuel.

Against the drawbacks attendant upon the use of an alcohol-gasoline mixture may be set the advantage claimed for it of

In South Dakota a farm supply organization conducts radio station WNAX for propaganda and sponsors alcohol blend gasoline stations.

The Bureau of Standards and the A.A.A. conducting tests of alcohol-gasoline blends near Washington, D. C.

reducing the tendency toward knocking in automobile engines. It is claimed, however, that this applies only to lower grade gasoline and that the same result can be obtained as readily by the use of Ethyl or the addition of lead.

From the economic viewpoint the chief objection to the use of alcohol as a motor fuel is its higher cost. Alcohol can be made from various waste materials, but whatever its source it is more expensive to produce than gasoline derived from crude oil. When manufactured from farm crops its cost is governed to a great extent by the market prices of these products. Of agricultural commodities the most economical to use in the making of alcohol probably is blackstrap molasses, but when molasses is selling above five cents per gallon it is cheaper to produce alcohol synthetically.

Because of the higher cost of alcohol as compared with gasoline it has been considered necessary, in countries where the production of alcohol is encouraged as a means of adding to farm revenue, to make its use in motor fuel compulsory or to encourage it by a tax differential. Where the alcohol blend is sold in equal competition with pure gasoline the majority of motor car operators show a definite preference for the latter. Where the primary object is to broaden the farmer's markets and to increase his revenues the usual recourse is to insist that the spirit be obtained from crops widely cultivated, such as corn (maize), sugar cane or sugar beets, and potatoes. Studies made by the United States Department of Agriculture, illustrated by charts and tables, have been published and indicate that with corn selling at 25 cents per bushel the cost of alcohol obtained from it is about 30 cents per gallon, and with 50-cent corn the price rises to nearly 40 cents per gallon.

Addition of 10 percent of alcohol to gasoline would represent an increase in cost of probably three to four cents per gallon. With the purpose of obtaining more exact data on costs the Chemical Foundation, which is the leading proponent in the United States of the use of alcohol as motor fuel, has arranged with a private company for the equipment and operation of an alcohol plant at Atchison, Kansas. In this plant alcohol will be produced from various farm crops and a careful check on manufacturing costs will be kept by a leading firm of accountants. When the results of operations over a considerable period become available it will be possible to apply more exact information to this question.

Accepting the estimate of three cents per gallon as representing added cost of a 10 percent alcohol mixture in order to arrive at a rough approximation of the difference, it appears that the increased cost to motorists of the United States of the 18,167,352,000 gallons consumed in 1935 would be $545,020,560. To this must be added a further amount to cover the 4.50 percent deficiency of power in alcohol as compared with gasoline. This would mean the consumption of 817,530,840 additional gallons representing a cost to consumers of $147,155,530 or a total bill of $692,176,090 chargeable to alcohol. If the use of alcohol was accomplished through a remission of taxes on the mixed fuel, the cost would fall on the general body of taxpayers rather than on motor vehicle operators but it would have to be met by someone.

Since the purpose behind the movement to require an inclusion of alcohol in motor fuel is to enable the farmers of the country to sell more of their products, it is worth while to consider how the farmer will fare under such an arrangement. Using 1935 consumption as a base we find that with a 10 percent alcohol mixture the total amount of fuel used would have been approximately 19,000,000,000 gallons, of which 190,000,000 gallons would have been alcohol. Assuming that this was derived from corn it would mean, on the accepted basis of 2½ bushels of corn to a gallon of alcohol, that with corn selling at 50 cents per bushel on the farm 475,000,000 bushels would be added to corn consumption and $287,500,000 to the farmer's gross income. Since, however, the farmers of the United States are estimated to use 25 percent of the motor fuel consumed, the farm population would be paying a quarter of the increased cost resulting from the use of alcohol as motor fuel or $173,000,000, so that when the expenses of producing the additional 475,000,000 bushels of corn were deducted the farmer's net gain might be converted into a minus quantity.

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Dr. H. H. Dickinson (kneeling), Bureau of Standards, explaining equipment used in tests to Rep. E. M. Dirkson (left), Capt. Eddie Rickenbacker, and Ernest Smith, president of the A.A.A.

Motor Fuels of the Future

*By Floyd F. Kishline**

Chief Engineer, Graham-Paige Motors Corporation

CONSIDERATION of the use of even small percentage blends of alcohol with gasoline projects several highly controversial aspects, about which there is a wide division of opinion. Certainly, however, the indicated eventual necessity of some change in fuel can best be met by cooperation of refiners, engineers, and chemists for solution, instead of uselessly debating whether such a thing can or cannot be done. Whether a blended fuel can be produced at the equivalent price of gasoline is important only at the moment, in view of predicted certainty of future gasoline price increases controlled by the supply and demand influence on crude oil costs.

The labor of many able and experienced men has been and is being directed on the fuel problem, and if the majority opinion is correct that alcohol offers the best possibilities, then we engineers must overcome our natural inclination to let well enough alone, and instead help attack the job without prejudice, if sooner or later it must be done.

Compulsory use of alcohol in fuel has apparently not proved very successful in other countries, which is not surprising. Public acceptance of any new product is in the main proportional to the relative merits of that product, advertising and distribution being equal. Possibly these blended fuels were not suited to the engines, but were forced into use by law before a practical adaptation of engine and fuel to each other was given consideration. Such procedure would probably meet with success in America similar to that of the prohibition laws.

It is not my intention to attempt a discussion of a chemical or technical nature as applied to fuels. After reading the results of tests of alcohol blends very ably made by competent men, it is evident that the ground has been covered as far as experimental results with present engines and blends are concerned. While these results are slightly contradictory, minor differences in conditions may have existed. Taking an average would indicate very little difference from straight gasoline.

If, however, the chemist and producer should offer a better fuel, it is my opinion they would find the engineer ready to take advantage of it, just as we did the 70-octane gasoline. Our company raised compression ratios in our engines from 5.6:1 up to 6.5:1 by use of aluminum heads with the better fuels in 1932, and gained from five to ten percent in economy. Through subsequent refinements, we are now using 6.7:1 and supercharging. We are getting slightly over one horsepower for each two cubic inches displacement, with still better economy.

At the present moment, we are stopped in this direction by 70-octane fuel. With a 76-octane fuel, we could employ over 7:1 and again improve economy.

Emphasizing the importance of high compression ratios, it is interesting to note the development of cars for the Indianapolis races, where in 1934 a limitation of 45 gallons total fuel was imposed for the 500 miles. In that year, compression ratios of from 8.5:1 to 13.8:1 were used and the winner averaged 104.8 m.p.h. and 14.1 miles per gallon. All these cars used special fuels of course.

In preparing a stock engine for this race, we used 9:1 ratio, the fuel being commercial non-premium gasoline with 12 c.c. of lead per gallon added.

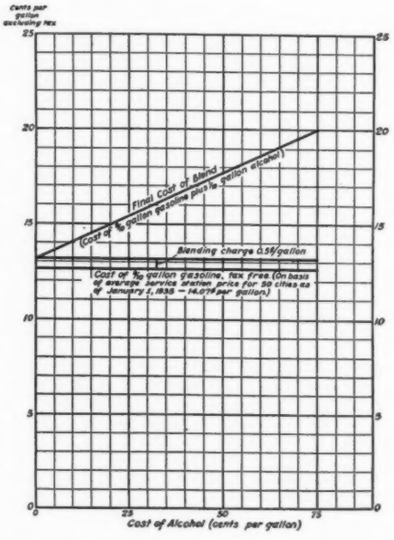
In 1935, the winner, using a high compression engine, averaged 106.2 m.p.h., using less than the 42.5 gallons then permitted.

This year, only 37.5 gallons will be allowed, but superchargers may be used. A proposal to lower the fuel octane instead of further reducing the total allowable amount met with the unanimous objection that such a rule would obsolete nearly all the engines the entrants now own and use for other events.

The Douglas transport airplane is powered by engines with over 6:1 compression ratio and supercharged for maximum horsepower at 8,000 ft. altitude on fuel of less than 80-octane, but carries separate tankage of 87-octane fuel for taking off and climbing at lower altitudes, again proving the importance of high compression pressure where maximum economy and power are vitally necessary, and that better fuel makes such an airplane possible.

As gasoline engines approach Diesel engine compression ratio, they may, to a large extent, approach Diesel engine part load economy, and this progress is dependent on available fuel. Former mechanical limitations in increasing compression ratios such as valves, spark plugs, pistons, piston rings, cylinder heads, and gaskets have been largely overcome, and I repeat we are ready for fuel. It would be desirable to have lower gum and oxide deposits resulting from combustion, no higher vapor pressure, and a flatter distillation curve than present prevalent gasolines, as well as 78 to 80-octane rating. Outside of that, we don't need much, Mr. Chemist.

In respect to alcohol, there has been some confusion in the matter of power obtainable. While alcohol has a lower heat value per unit of volume than gasoline, a cubic foot of perfect mixture with air of each has almost exactly the same calorific value, so the only point involved is the relative cost of the fuels.


Cents per gallon excluding tax
25
20
15
10
5
0
Final Cost of Blend
(Cost of 9/10 gallon gasoline plus 1/10 gallon alcohol)
Blending charge 0.5¢/gallon
Cost of 9/10 gallon gasoline, tax free (On basis of average service station price for 50 cities as of January 1, 1936 — 14.07¢ per gallon)
25
50
75
Cost of Alcohol (cents per gallon)

Cost of alcohol-gasoline in relation to cost of alcohol, based on U.S. Dept. of Agriculture alcohol cost figures.

However, if a fuel offered less combustion chamber deposit, lower mixture temperature necessary for evaporation, and a higher octane than gasoline, it might still be highly desirable for use in automobiles, even though it fell somewhat short by comparison in some other respects, provided such shortcomings are not too difficult to surmount.

It seems to me at the moment that the principal problem in the use of alcohol in a low percentage blend, might be the cost of producing the alcohol.

I believe automotive engineers as a group in industry and science, are patriotic and possess necessary vision to qualify for cooperation in securing our future fuel requirements and assisting in the stabilization of industry and agriculture.

*From a paper presented at Second Dearborn Conference, May, 1936.

Europe's Huge Bill for Alcohol Fuel

Statistical Examination Shows Tremendous Yearly Losses Sustained by Motorists and State Treasuries Through Compulsory Inclusion of Alcohol in Motor Fuel. *By Dr. Oskar Tokayer*

COMPULSORY sale of alcohol as motor fuel has been adopted in a dozen European countries. In practically every case the compulsory feature is an outgrowth of the recent depression. In fact the whole idea is a typical product of the state of mind induced by the depression which looks to government support of particular groups and classes at the expense of other less favored classes or of the whole body of citizens.

It is true, of course, that before 1929 motor fuels were available in which alcohol was an ingredient, but their use was not obligatory.

Attempts to use alcohol for such purposes date back to the time of the world war. In certain countries as, for example, France, Sweden, Germany and Czechoslovakia, experiment was translated into practice and alcohol-containing fuels were placed on the market long before the economic crisis. Their use, however, was limited and relatively unimportant. The movement for the employment of alcohol-gasoline on a large scale and under government compulsion did not set in until 1930. Once it had begun it made rapid progress, as the accompanying figures show.

Alcohol Used as Motor Fuel in European Countries

	metric tons	gallons
1930	58,700	19,376,000
1931	121,000	39,964,000
1932	182,270	60,195,000
1933	361,650	119,435,000
1934	445,340	147,074,000
1935	576,448	191,381,000

In different countries the movement has been ascribed to widely divergent motives. Help for distressed agricultural industry was the first and chief argument used, but the more it became clear that only a small section of agriculture was benefited, and that it was by no means certain whether, on balance, the benefit was a real one, the more it was sought to justify compulsory mixture by other claims. Lack of domestic oil production, the desire to reduce dependence upon foreign supplies of motor fuel in time of war, the setting-up of "national industries," shortage of exchange currency, were grounds upon which it was sought to defend such measures and to justify the financial sacrifices which they entailed. All evidence to the contrary, all logical objections to the gross discrepancy between expenditure and benefits which is inherent in the policy of alcohol mixtures, were unavailing to check the carrying out of that policy once it had become the law of the land. Once compulsion has become established it has the inbred capacity of extending the scope of its application. Once a prerogative has been obtained those who benefit by it cannot be expected to agree to its abandonment.

EUROPE has been the chief testing ground for the compulsory use of alcohol as motor fuel which has been extensively, and in many cases successfully, agitated during the past five or six years. While alcohol admittedly is inferior in certain respects to gasoline for purposes of combustion, the writer of the accompanying article does not emphasize these considerations. He applies instead the crucial test of the economic justification for requiring an admixture of alcohol to motor fuel. He shows that from whatever source derived, alcohol is several times as expensive as gasoline, and that even where tariffs are highest the cost of alcohol is greater than gasoline plus the customs charge. He finds that eleven countries with a total motor fuel consumption of 576,448 tons are sustaining a yearly loss of over $150,000,000 or an average of $36 per car through this expensive policy.

Inferiority of Alcohol

IT IS WELL established that the use of alcohol as motor fuel in internal-combustion engines is uneconomic by comparison with gasoline. Not only is the cost of producing alcohol, even in countries most favored in this respect, several times that of gasoline, but engine performance on alcohol, other things being equal, is less than on gasoline, so that for the same mileage there must be a larger consumption of fuel and hence a considerable increase in operation costs. In certain countries the price of alcohol is as much as tenfold the c.i.f. price of gasoline. Even where import duties on gasoline are most exorbitant, alcohol is invariably dearer than gasoline on which import duties and other taxes have been levied. So long, therefore, as gasoline remains available in sufficient quantity and at anything like the present price, it is quite certain that no genuine demand for alcohol as motor fuel will arise.

Alcohol's lower efficiency as motor fuel entails additional running costs. Whereas the heat value of gasoline is 10,500 calories, ethyl alcohol of 96 percent purity has only 6,000 calories, and of 100 percent purity only 6,360 calories. If, therefore, it is conceded that an addition of alcohol to gasoline in the relatively moderate proportion of 20–30 percent results in a mixture that gives little or no operating trouble, still the performance of such a mixture is proportionately lower. While the addition of alcohol improves the anti-knock quality of gasoline this does not compensate for its lower efficiency. It was pointed out by Prof. George Granger Brown of the University of Michigan, before the Dearborn Conference in May, 1935, after exhaustive experiments, that an admixture of 10 percent alcohol with a

gasoline of octane number 66 raises the octane number of the mixture to 73 and enables the compression ratio to be raised by about 5 percent. An increase of the compression ratio by 5 percent makes possible an increase of engine performance by 3 percent. On the other hand, the heat value is diminished to such an extent that fuel consumption is increased by 5 percent, even with a 10 percent mixture.

The price of alcohol varies as between country and country and depends largely upon the agricultural product from which it is obtained. In Europe the raw materials most in use are potatoes, sugar beet, rye and other cereals, molasses, grapes and orchard fruit. Besides these sulphite lye, a by-product of the manufacture of cellulose, is utilized as a source of alcohol. The price of alcohol is higher or lower according to which of these raw materials is employed. The alcohol obtained in the distillery normally contains a certain percentage of water, which is extracted by a process of rectification in order to render the alcohol suitable for admixture as a motor fuel, as a water content of only one to two percent may cause a separation of the alcohol and gasoline ingredients of the mixture and make the fuel unusable. The manufacture of absolute alcohol thus involves a further addition to the cost which is a considerable factor in the price.

The above is by no means the total cost of the alcohol mixture. The expenses of denaturing and mixing must be mentioned, as also losses in mixing, the cost of transporting, storing and selling the alcohol and the mixture, and all the outgoings in connection with handling, which naturally adds to its price.

Beyond this, the treasury in each country, that is to say the general body of taxpayers, suffers the loss of customs revenue from the gasoline displaced by the alcohol and therefore not imported.

Losses Exceed Gains

THESE LOSSES of revenue are proportionately larger where the import duty on gasoline is high, and where the consumption of motor fuel, and consequently of alcohol, is great. They represent, almost in their entirety, a loss to the economy of the country, because the surplus arising from the production and use of the domestic alcohol is much smaller than the deficit thereby caused to the revenue.

The extent to which the use of power alcohol is insisted upon varies country by country and, accordingly, the average percentage of alcohol in the blends sold. So also varies the mode of distribution of the resulting burden of extra costs. As a rule, the state fixes the basis for the quantities to be taken over and makes rules as to the manufacture of blends, but subject to these provisions, leaves it to the oil companies to dispose of the alcohol in the way most convenient to them. The exact proportion of alcohol to be used in mixtures is provided for in a few countries only.

An enforced engagement on the part of the petroleum trade to buy a certain percentage of alcohol without the simultaneous obligation to mix it with gasoline is in existence in France, Germany, Italy, Austria, Poland, Sweden, Spain and Jugoslavia. In those countries it is left to the discretion of the oil companies to prepare, within the limits of the law, the alcohol blend they deem most suitable. In Czechoslovakia, Hungary, Latvia and Lithuania the enforcement goes even further, as practically all motor fuels must contain a prescribed percentage of alcohol.

Apart from the above countries, alcohol admixture has been decided upon in principle in the Irish Free State and Bulgaria, but has not yet become an accomplished fact. In Switzerland the government is at present considering projects of a similar nature, while Holland, in view of the probable losses to the revenue, has so far hesitated to take any decisive step after thorough investigation of the proposal. Only in Belgium, Luxembourg, Finland and Greece has the measure been rejected because of economic reasons. Great Britain is the only country in Europe where alcohol is used as a motor fuel without state enforcement, and this because of a higher duty on motor spirit. The quantities in question which are sold by one or two companies are, however, relatively small.

The practical results of the application of the alcohol policy in individual European countries may be clearly seen from the following facts:

France

BLENDING of alcohol with gasoline has been compulsory in France for 13 years. Here, as elsewhere, the origin of this legislation is to be found in the demands of producers—in this case the producers of certain classes of agricultural products—rather than in the requirements of consumers. By passing the law of 28 February, 1923, out of deference to the complaints of the growers of sugar beet who found themselves unable to dispose of their surplus alcohol, the government of the day let loose upon the country a monster whose demands have grown steadily ever since.

At first, the quantities of alcohol which had to be taken over by the state at a fixed price were relatively small but, in recent years, these quantities and the consequent drain on the finances of the government, owing to the losses realized on the resale of the alcohol, and to the tax rebates necessary to secure its use for motor fuel, have grown by leaps and bounds. The total quantity of alcohol used for mixing with motor fuel during the period 1923–29 did not exceed 137,350 metric tons, or 45,349,115 gallons. On the other hand, in the five years 1930 to 1934, no less than 679,000 tons, or 224,687,100 gallons, were compulsorily taken over by the motor fuel distributors, and in 1935 alone it is estimated that as much as 293,600 tons, or 97,152,240 gallons, of alcohol were allocated for this purpose.

Turning to the financial aspect, it appears that in the twelve years 1923–34 inclusive the cost of 816,300 tons or 270,113,670 gallons of alcohol taken over by the Government Alcohol Monopoly, with a view to its resale for blending with motor spirit, amounted to 3,305,000,000 francs ($218,130,000), which figure is inclusive of the cost of handling, storing, dehydrating and denaturing the alcohol so taken over. The Monopoly also incurred further charges in connection with the storage and transport of the dehydrated alcohol, which are estimated to have added another 49,500,000 francs ($3,267,000). Faced with the problem of securing the use as motor fuel of these vast quantities of alcohol, the government has found itself forced to adopt expedients which, as long ago as 1932, the Public Works Commission of the Senate found

France—Loss to State on Sale of Alcohol

	Frs.	Frs.
Cost of Purchase, 1923–1934	3,305,018,887	
Add 1½% as shown	49,575,283	
Cost of Purchases, 1935	994,702,000	
		4,349,296,170
Proceeds of Sales, 1923–1934	1,447,625,000	
Proceeds of Sales, 1935	469,582,000	1,917,207,000
		2,432,089,170
Exemptions from Taxes, 1923–1934	255,283,000	
Exemptions from Taxes, 1935	302,252,000	
Losses of Customs Receipts, 1923–1934	821,354,000	
Losses of Customs Receipts, 1935	345,624,000	1,724,513,000
Total direct loss for the years 1923–1935		4,156,602,170

were having a serious influence on the finances of the government. The means adopted to reconcile the French public to the substitution of a percentage of costly alcohol for much cheaper gasoline have been as follows:

In the first place, the alcohol taken over by the Alcohol Monopoly from the producers is resold to the gasoline distributors at prices which represent only a fraction of its cost. In the second place, considerable tax exemptions are conceded to motor fuels containing alcohol, and these vary according to the percentage contained in the mixture. Until the summer of 1933, alcohol was blended only with second-grade gasoline, forming the mixture known as Carburant Poids Lourd, which contains 25–35 litres of alcohol to 100 litres of gasoline, but in 1933 the government found that the necessary quantities of alcohol could be disposed of only if distributors were also authorized to add between 10 and 15 percent of alcohol to their first-grade gasoline (Essence Tourisme). In each case the interior tax of Frs. 32 per hectolitre (2.1 cents per gallon) and the Taxe de Péréquation of Frs. 10.40 per hectolitre (0.69 cents per gallon) are remitted on the alcohol content of the mixture, while the Carburant Poids Lourd also benefits by the remission of half of the road tax of Frs. 50 per hectolitre (3.3 cents per gallon) of mixture. From 1923 to 1935 inclusive, the state's direct loss on the sale of alcohol amounted to Frs. 2,432,000,000 ($160,510,000), while the total loss of customs and tax receipts through the exemptions given to alcohol blends amounted to Frs. 1,724,500,000 ($113,817,000), giving an aggregate loss to the state of Frs. 4,156,500,000 ($274,923,000). These losses for the year 1935 alone exceed Frs. 815,000,000 ($53,790,000).

The manner in which these enormous losses are arrived at is clearly shown in the accompanying table, published by the PETROLEUM PRESS SERVICE recently.

It would be hard to produce a comparable instance of an industry living parasitically upon other industries and making them serve its purpose. Under the stimulus offered by a profitable yet entirely artificial outlet, the alcohol industry has expanded to an extent which was never contemplated and which constitutes a danger to the stability of the national finances.

Germany

THE PRODUCTION of alcohol plays an important part in German agriculture on account of the outlet it affords for the surplus production of potatoes. The decrease in consumption of potable and industrial alcohol during the post-war

French distributors find it advantageous to emphasize the absence of alcohol in their product.

period resulted in the accumulation of very large stocks of alcohol in the hands of the Alcohol Monopoly. The rise in stocks led in 1930 to the passing of a law which required importers and producers of gasoline, benzole and kerosene to purchase alcohol from the Alcohol Monopoly equivalent to 2½ percent by weight of their customs clearances of mineral oils of less than .830 specific gravity, benzole, and similar light coal tar oils. The purchasers had the alternative of taking delivery of the alcohol and disposing of it in motor fuel or of re-selling it to the Monopoly at a very much lower price. It may thus be seen that the law had from the outset the character of a direct tax on the vendor of motor fuel for the benefit of the potato grower.

Since 1930 the burden upon the distributors and the consumers of motor fuel has steadily increased. The percentage of alcohol to be purchased was raised to 3.5 percent on customs clearance of all light oils on 1 April, 1931, to 6 percent on 1 October, 1931, and on 1 October, 1932, the percentage was again increased in the case of gasoline and benzole imports or production to 10 percent, while it remained at 6 percent in the case of kerosene. The quantities of alcohol put into consumption for motor fuel purposes under this law have increased rapidly in recent years, not only on account of the rise in the percentage but also as the result of the development in the consumption of motor fuel. From 35,000 tons, or 11,620,000 gallons, in 1930, the quantity of alcohol so used increased to 90,000 tons, or 29,880,000 gallons, in 1932 and to 180,000 tons, or 59,760,000 gallons, in 1935. In the latter year the consumption of motor alcohol represented approximately 65 percent of all the alcohol taken over by the Monopoly. About 70 percent of this was potato alcohol, the balance being mainly alcohol manufactured from molasses and sulphite lye, a waste product of the paper industry.

Potato alcohol is mainly produced in small agricultural distilleries at a very high cost. The average price paid by the Monopoly to the producers for such alcohol is 48 pfennigs per litre (73.20 cents per American gallon). In addition, the Alcohol Monopoly incurs heavy expenses in connection with the dehydration, storage and distribution of the alcohol which it purchases from these numerous small distilleries. It is admitted that the Monopoly's selling price to the motor fuel distributors—50 pfennigs per litre (76.25 cents per gallon) delivered at purchaser's railway station—does not cover its expenses as regards this type of alcohol. In addition, the government loses the whole of the duty which would have been paid upon an equivalent quantity of imported or home-refined gasoline, while the user is penalized by having to purchase gasoline containing alcohol, which costs from 2½ to 3 times as much as a similar quantity of duty-paid gasoline. The accompanying calculation illustrates the total cost of the compulsory use of alcohol mixtures to the German State and consumer in 1935.

Germany—Loss to the State

Alcohol Monopoly Administration's loss on agricultural alcohol		RM. per hectolitre	Cents per gallon
Average buying price from agricultural distilleries (potato alcohol)		48	72.20
Average cost of dehydration, storage, transport and administration		22	33.55
Total cost to the Monopoly		70	105.75
Selling price free buyers' railway station		50	76.25
Loss		20	29.50
Loss on 126,000* metric tons of potato alcohol supplied for mixing as motor fuel (RM. 20 per Hl.-RM 250 per metric ton)		RM. 31,500,000	or $12,694,500
Loss of Import Duty and/or Excise duty which would have been payable upon an equivalent quantity of imported gasoline or home-refined gasoline from imported material	RM. 219.30 per Metric Ton		
Loss of 2½ Compensating Tax upon c.i.f. duty paid value of above gasoline	RM. 6.10 " " "		
	RM. 225.40 " " "		
On 180,000 metric tons		RM. 40,572,000	or $16,350,500
Total loss to the state		RM. 72,072,000	or $29,045,000

* It is assumed that potato alcohol represents roughly the same proportion of the alcohol disposed of for motor fuel as it does of all the alcohol taken over by the Monopoly, that is to say, 70 percent.

Germany—Loss to the Consumer

Cost of 180,000 metric tons of alcohol at RM. 50 per Hl. or RM. 625 per metric ton	RM. 112,500,000	or $45,337,500
Extra expense incurred in blending, etc. at (say) RM. 100 per metric ton	RM. 18,000,000	or $ 7,254,000
Total cost of alcohol to the user	RM. 130,500,000	or $52,591,500
The same quantity of gasoline could have been imported and sold at RM. 275 per metric ton	RM. 49,500,000	or $19,948,500
Therefore the extra cost of using 180,000 metric tons of alcohol was	RM. 81,000,000	or $32,643,000
The total cost of compulsory alcohol admixture to the German government and people in 1935 therefore amounted to	RM. 153,000,000	or $61,688,000

Motor fuel consumption in Germany in 1935 was approximately 2,000,000 tons, the direct additional cost to the consumer of the alcohol admixture was equal to RM. 40½ per metric ton of motor fuel used or Pf.3 per litre; and to make good the loss to the government would require a further tax of RM. 36 per metric ton or Pf. 2.7 per litre.

Since the beginning of 1935 a definite change in the policy of the Alcohol Monopoly is apparent, which suggests that it is anxious not to increase further the losses incurred by the sale of potato alcohol for motor fuel. The obvious method, of reducing the percentage of alcohol to be mixed with motor fuel, has not been adopted, however; the Monopoly has instead displayed increased interest in obtaining the additional quantities of alcohol which are required to keep up the 10 percent mixture by cheaper methods. A law which came into effect in January last authorizes the addition of not more than 15 percent of methyl alcohol to the ethyl alcohol supplied by the Monopoly for motor fuel purposes. In addition, the Alcohol Monopoly intends to increase its production of wood alcohol; three plants already are producing alcohol by this process. While the production costs of synthetic methyl alcohol and wood alcohol are considerably lower than that of potato alcohol, they are still completely uneconomic, and are dependent upon subsidies and special protection for their survival.

Italy

ALTHOUGH alcohol production in Italy hitherto has been small in comparison with certain other European countries, a law was passed in 1930 which allocated one-quarter of the country's production of industrial alcohol to be used for mixing with motor fuel. The quantities of alcohol actually used pursuant to this decree have varied between 5,000 and 7,000 tons per annum. Since the commencement of the dispute between Italy and the League of Nations, strenuous efforts have been made to increase the production of alcohol for motor fuel purposes.

The regulations require alcohol blends sold for motor fuel to consist of 20 percent

alcohol and 80 percent gasoline, but, owing to difficulty in disposing of the mixture commercially, one large distributor has found it necessary to market a blend containing 20 percent alcohol, 10 percent benzole and 70 percent gasoline. Until September, 1935, the price charged for alcohol to the petroleum companies was Lire 145 per hectolitre, (43.14 cents per gallon) to which Lire 10 (2.98 cents) had to be added to cover the cost of denaturing, making a total cost of Lire 155 per 100 litres (46.12 cents per gallon). Under the influence of sanctions, the Italian government has taken steps to augment the supply of sugar beet alcohol, the ultimate objective being the production of sufficient alcohol to allow 20 percent to be mixed with all gasoline used as motor fuel. These measures did not, however, result in any material increase in the supply of fuel alcohol during 1935. The cost price of alcohol, however, was raised from Lire 145 to Lire 220 per hectolitre (65.44 cents per gallon), in conformity with the special war-taxes imposed on gasoline.

Spain

As THE result of agitation by the Spanish alcohol producers, a decree was promulgated on the 6 June, 1935, obligating the Spanish petroleum monopoly to take over 140,000 hectolitres (3,696,000 gallons) of alcohol, produced from molasses and grapes, for mixing with motor fuel, at a price of 100 pesetas per hectolitre (52 cents per gallon). Another clause of the same decree authorized the Finance Minister to increase the price of motor spirit and to raise the import duty on petroleum products to the extent necessary to compensate the loss of revenue caused to the petroleum monopoly as a result of these compulsory purchases of alcohol. No immediate increase in selling prices was made, but during the last few weeks an advance of 0.10 peseta per litre in the selling price of gasoline and gas oil throughout Spain has been announced with effect as from 1 June, 1936.

Czechoslovakia

Czechoslovakia has a surplus of many materials applicable to the manufacture of alcohol. Potatoes, sugar beet and cereals not suitable for foodstuffs are produced in larger quantities than can be either consumed at home or disposed of by export, so that producers endeavored to utilize their surplus in the manufacture of alcohol. Apart from this the country has a comparatively modest production of methyl alcohol. The annual output of alcohol from agricultural raw materials amounts to some 1,000,000 hectolitres (26,416,000 gallons) of which more than half is used for motor fuel purposes. The output would be considerably larger if it were not restricted because of the existing system of quotas.

"Without Alcohol"—two words sufficient to attract Continental motorists to this pump.

Compulsory alcohol mixing was introduced by decree on 1 September, 1932, and calls for an alcohol admixture of at least 20 percent, but not more than 25 percent, of dehydrated alcohol in all motor fuel consumed in the country. A few years previously the alcohol monopoly had on its own initiative placed on the market an alcohol mixture which was sold under the brand name of Dynalkol, but which met only with a very modest demand for private use. This mixture, consisting of 26 percent alcohol, 70 percent gasoline and 4 percent benzole, is still dealt in, but practically the only users of it are the Post Office and the State Railways.

The taking up price of the alcohol by the gasoline marketing firms is Kc. 486.50 per hectolitre free Prague, or 76.4 cents per gallon. This price includes a turnover tax of Kc. 125.00 or 19.6 cents per gallon and a state control tax of Kc. 40.00 per hectolitre (6.3 cents per gallon). Including these, taxation on the total cost of the mixture is indicated in the accompanying table.

Czechoslovakia—Loss to the Consumer

Alcohol sold for use as motor spirit in 1935—42,477 metric tons or 14,028,000 gallons.

		Kc. per Hl.	Cents per gallon
Alcohol Monopoly's price delivered mixing plants Prague		486.50	76.4
Tois includes:			
Turnover Tax	Kc. 125		19.6
State Control Tax	Kc. 40	165.00	6.3
		321.50	50.5
	or	Kc. 401.88 per 100 kilos.	
Gasoline duty free and tax free could have been bought f.o.r. Bratislava at	Kc. per 100 kg. 70.00		8.0
Freight Bratislava Prague	17.00	87.00	1.9
			99
So that excluding the cost of mixing and without allowing for profit, finance charges, insurance, extra handling involved, leakage and evaporation losses, the extra cost of alcohol was		Kc. 314.88	36.4
Therefore the cost to the consumer of the 42,477 metric tons of alcohol used for motor fuel during 1935 above the cost of the same quanity of gasoline was		Kc. 133,750,000 or $5,349,800	

Czechoslovakia—Loss to the State

The relationship between the prices paid by the Alcohol Monopoly for its supplies and the prices charged to the petrol companies for mixing is not known. The government, however, includes in its selling prices for alcohol, as shown above, the following taxes:

	Kc. per Hl.	Cents per gallon
Turnover Tax	125	19.6
State Control Tax	40	6.3
	Kc. 165	25.9 cents

Last year the interested agricultural circles in Czechoslovakia put forward a demand for a further increase in the percentage of alcohol from 20 to 25 percent, but, in view of the already excessively high taxation of motor fuel, the government refused this request.

Sweden

Many years before the economic crisis set in, motor fuels containing alcohol

Motorists show perference for pure motor fuel, as the sign above testifies.

were sold in Sweden on a very small scale. The impulse towards mixed fuels originated from the manufacturers of cellulose, who produced spirit in considerable quantity. The alcohol output of Sweden amounts to some 23,000–25,000 tons (7,500,000 to 8,500,000 gallons), of which about half is from sulphite lyes, and the remainder from potatoes, molasses and yeast. As the price for the sulphite alcohol is relatively low, a mixture of gasoline with such alcohol, known as Lättbentyl, was placed on the market and met with a fairly good sale, as its price was practically the same as that of pure gasoline. In 1931 the government was induced to come to the aid of the distilleries and ordered all government services to use alcohol mixtures, provided that the price of these was not more than 10 percent in excess of the price of gasoline. To prevent an extension of the government's mixture policy the gasoline marketers declared that they were prepared to take up a certain quantity of sulphite alcohol at a price of 24 öre per litre (23.26 cents per gallon). For a long time the mixture was sold at a small premium, but since the middle of 1934 the price of the mixture has been the same as for gasoline, so that the distributors suffered a loss on their Lättbentyl business, notwithstanding the exemption of motor alcohol from all official taxes.

In order to render possible an increased consumption of alcohol for motor fuel, a decree was issued in July, 1934, and went into effect on 1 October, of that year, providing for the use of molasses, sulphite and yeast alcohols for this purpose to a larger extent than before. The alcohol management (Spritcentralen) was directed to accept sulphite alcohol up to a maximum of 400,000 hl. (10,566,000 gallons) per annum, while the gasoline marketing firms were compelled to take over from the Spritcentralen a prescribed percentage of alcohol for mixing purposes. In the first quarter of 1935 the quota was 3.6 percent, but in the later portion of that year this was reduced and amounted in the last quarter to about 3 percent. The above decree led to a further increase in 1935 of alcohol used for motor fuel purposes, which reached 12,250 metric tons (4,045,600 gallons). The cost of the alcohol of 99.6 percent purity was 32.00 öre per litre (31 cents per gallon) compared

with about 14.9 öre per litre for gasoline c.i.f. Therefore, the mixed fuel involves a serious burden on Swedish industry, as the accompanying summary shows.

Sweden—Loss to the Consumer

Alcohol sold for use in motor spirit during 1935—12,250 metric tons, or 4,067,000 gallons.

	Öre per litre	Cents per gallon
Alcohol Monopoly's price for 99.6% denatured alcohol delivered main cities by tank car to mixing plants	32.00	31.00
Cost of mixing	1.38	1.34
Cost of alcohol to oil companies without allowing for profit, finance charges, insurance, extra handling involved and evaporation losses	33.38	32.34
On 12,350 metric tons of spec. grav. 0.8	Kr. 5,111,312 or $1,308,496	
The same quantity of imported gasoline would have cost $23.06 per metric ton c.i.f. at Exchange Kr. 3.91 to the dollar = Kr. 90.19 per metric ton	1,104,828	
Handling and delivery charges Kr. 15.50 per metric ton	189,875	
Import Duty Oere 10.1 per litre = Kr. 1,694,863	Kr. 2,989,566 or $	756,329
Therefore, the extra cost to the consumer of the compulsory mixture of alcohol in 1935 was	Kr. 2,121,746 or $	552,167

To this must be added the additional taxation which devolves upon the consumer consequent upon the loss of import duty to the state.

Sweden—Loss to the State

Loss of import duty upon 12,250 metric tons of gasoline which would have been imported for use as motor fuel had not the admixture of alcohol been compulsory

at Oere 10.1 per litre ... Kr. 1,694,863 or $ 433,885

It is understood that alcohol prices to the oil companies must represent actual costs of the Alcohol Monopoly.

Hungary

THE DECISIVE effect of the agricultural crisis on economic policy is also felt in Hungary, where the addition of alcohol to motor fuel has been carried to extreme lengths, with consequent heavy burdens on the community. This has been the more unfortunate because the Hungarian people, by reason of the severe mutilation of their territory by the Treaty of the Trianon, have suffered serious curtailment of their purchasing power, and have a stiff fight against adversity even under favorable conditions.

In 1929 the Hungarian government promulgated a law to the effect that the admixture of alcohol with all gasoline used for motor fuel purposes and having a specific gravity ranging from 0.736 to 0.770 should be 20 percent. Oddly enough, this law does not apply to motor vehicles employed for agricultural purposes. Pure gasoline of a specific gravity of 0.735 and under thus escaped admixture, but it was subjected to a special tax by which the retail price at the filling station was increased by 0.10 Pengö per litre (11.20 cents per gallon). This enormous addition naturally converts the use of pure gasoline into a luxury. About 90 percent of the motor fuel consumption in Hungary consists at present of alcohol mixtures.

The price of the alcohol to the motor fuel distributing companies is 70 Pengö per hectolitre (78.42 cents per gallon) delivered into buyer's tank-cars at the seller's depot. The mixture bears the brand MOTALKO, but each company sells its own quality of mixture under that name. The accompanying table shows the burden imposed upon the Hungarian people by the compulsory mixed fuel.

To what extent this burden has helped agriculture we have obtained the following facts: The principal source of the alcohol supply is maize, of which there is a surplus, and of which there is an annual yield of 2,000,000 metric tons. For the production of one ton of 99.5 percent alcohol about 3½ tons of maize is necessary. Therefore, to produce the alcohol required for the mixed fuel in 1935 there was needed 30,558 tons of maize, or 1.5 percent of the total harvest. These figures speak for themselves.

Hungary—Loss to the Consumer

Alcohol sold for use in motor fuel in 1935 ... 8,731 metric tons, or 2,899,216 gallons.

	Pengoes per metric ton		Cents per gallon	
Alcohol Monopoly's price delivered in buyers' tankwagons at seller's depots is Pengoes 70 per hl.	875.00		71.9	
Weight to mixing point, cost of denaturing and mixing	33.85		3.3	
Cost of Alcohol		908.85		75.2
Average cost of lowest taxed gasoline before adding taxes	107.33		8.8	
Consumption tax	150.00		12.3	
Phasic tax	4.11	261.44	0.3	21.4
Extra cost of alcohol to consumer		647.41		53.8

For 8,731 metric tons alcohol used in 1935 for motor fuel ... Pengoes 5,653,000 or $1,673,288

In addition the consumer is burdened by additional taxation which devolves upon him consequent upon (1) loss of taxes to the government on alcohol (tax free) which is used in lieu of gasoline and (2) any adverse financial results to the government arising out of its trading in alcohol.

Hungary—Loss to the State

Loss of taxes which would have been forthcoming on gasoline were not the use of alcohol compulsory: 8,731 metric tons at Pengoes 154.11 per metric ton ... Pengoes 1,346,000 or $398,416

The financial results of the State's trading in alcohol are not known.

To this enormous addition naturally converts the use of pure gasoline into a luxury. About 90 percent of the motor fuel consumption in Hungary consists at present of alcohol mixtures.

The price of the alcohol to the motor fuel distributing companies is 70 Pengö per hectolitre (78.42 cents per gallon) delivered into buyer's tank-cars at the seller's depot. The mixture bears the brand MOTALKO, but each company sells its own quality of mixture under that name. The accompanying table shows

interests it promulgated a decree which, in July, 1932, empowered the Council of Ministers to order the compulsory addition of alcohol to gasoline. In the hope of avoiding the troubles and difficulties inseparable from compulsion, the oil companies announced their readiness, following an agreement reached by them with the management of the monopoly in January, 1933, to take delivery for that year's trade of a quantity of alcohol equivalent to nine percent of their gasoline sales of the preceding year, and therefore amounting to 90,000 hectolitres. For succeeding years it was agreed that for each added ten percent by which gasoline sales should increase, an additional two percent alcohol should be taken over, with the proviso that the maximum quantity of alcohol should not amount to more than 30 percent of the gasoline sales of the preceding year.

The price for the alcohol varies and is based upon the prevailing retail price of gasoline. At first the alcohol price was fixed at 0.395 Zloty per litre (28.20 cents per gallon), but it fell temporarily, following a reduction in gasoline prices, to 0.26 Zloty (18.56 cents). The loss of the state on the sale of the motor fuel blended with alcohol varied accordingly, because the price at which the state acquires the alcohol is considerably higher than the price charged to the petroleum companies.

The principal source of alcohol in Poland is potatoes, which are responsible for some 90 percent of the output. The remainder is obtained from molasses, barley and yeast. As the price at which the government acquires potato alcohol varies between 0.65 and 0.80 Zloty per litre (46.40 to 57.10 cents per gallon), it is easy to calculate the loss on the motor

Poland

ALTHOUGH Poland has a petroleum industry which has to contend against an insufficient domestic demand and is therefore compelled to export its surplus products at considerable loss, this consideration has not deterred the government from turning its attention to alcohol mixtures. Under pressure from agrarian

fuel mixture if it is considered that in 1935 about 7,400,000 litres of alcohol (1,955,000 gallons) were sold for this purpose.

Jugoslavia

LIKE OTHER European countries in which the agricultural interest has a predominating political influence, Jugoslavia has introduced compulsory alcohol mixing. With this object a law was passed on 18 April, 1932, which became effective in February, 1933, and which directed an admixture of 20 percent of alcohol with gasoline, aviation gasoline alone being exempt. In November, 1933, the compulsory mixing was made optional, but government policy was still directed to the promotion of alcohol sales for motor fuel purposes and it endeavored to attain this object by raising the consumption tax on pure gasoline by a margin of some 45 percent above that on alcohol mixtures.

Manufacture of alcohol in Jugoslavia has as raw materials potatoes, maize and molasses. In 1935 some 6,592 tons (2,177,000 gallons) of alcohol was sold for motor fuel purposes. The alcohol price charged by the monopoly (Zwanzentrale) is 5.77 dinars per kilogram (40.16 cents per gallon) ex factory; and to this must be added the average cost of freight to the mixing plant, 0.25 dinars (1.74 cents). By the difference between the consumption taxes on gasoline of 5.00 dinars per kilogram (41.90 cents per gallon) and the tax on mixture of 3.50 dinars, the state suffers a loss of 1,500 dinars per ton, which, on last year's sales of 6,592 tons, amounted to 9,888,000 dinars ($227,424).

Concerning the popularity (or the reverse) of the alcohol mixture, it may be remarked that the sale of pure gasoline in Jugoslavia is on the increase in spite of the additional tax imposed upon it.

Latvia

THE SMALL Baltic State of Latvia, which is predominantly agricultural, introduced compulsory alcohol mixture as from 7 December, 1931. The original law provided for an alcohol percentage of 25 percent to 75 percent gasoline, but a law was announced on 11 July, 1933, by which it was provided that the mixture in the summer months, 1 May to 30 September, must consist of 50 percent by volume of alcohol, and for the remainder of the year of 33⅓ percent of alcohol to 66⅔ percent of gasoline.

At first the price of alcohol to the gasoline companies was 1 lat per litre, but it was later reduced to 0.28 lat and remained at this level until April, 1935, when it was increased to 0.48 lat. Even at the present price the state takes a loss on the average price of alcohol, which costs 0.76 lat if obtained from potatoes and 0.42 lat if obtained from molasses.

In 1935, alcohol to the extent of 5,457 metric tons was used for motor fuel purposes, representing a total cost to the oil companies of 2,899,200 lats. A similar quantity of gasoline, at a c.i.f. price of 80.34 lats per ton ($25.83) would have cost 438,415 lats, to which would have been added transport and trading costs of 15 lats per ton, or 81,855 lats, therefore making the total cost 520,270 lats. Adding import duties and taxes of 367.70 lats per metric ton, or 2,006,539 lats, the following figures show the position:

	Lats	Dollars
Cost of alcohol	2,899,200	932,219
Cost of same quantity of taxed gasoline	2,526,809	812,479
Loss to the consumer	372,391	119,740

To this must be added the loss of revenue to the state from (1) the import duty (2) the difference between the cost of production of the alcohol and the price at which it is sold to the gasoline companies. At the above rate of import duty of 367.70 lats per ton, there is a loss of 2,006,539 lats. The loss on the sale of alcohol may be estimated, taking the average difference between the state monopoly's buying and selling prices as 0.30 lat per kilogram, at almost 2,000,000 lats ($643,087). The total burden placed upon Latvian economics by the compulsory alcohol mixture may therefore be shown as follows:

	Lats	Dollars
Loss to the consumer	372,391	119,740
Loss to state in import duties	2,006,539	645,189
State's loss on the alcohol itself	2,000,000	643,087
Total loss	4,378,930	1,408,016

For a small country, of low purchasing power, this is truly a heroic sacrifice.

Austria

THE LEGAL basis of compulsory alcohol mixing in Austria was provided by the law of 28 January, 1931, which gave the Finance Minister power to order the admixture of 25 percent with gasoline on condition that the price of the alcohol should not exceed the wholesale price of gasoline. However, owing to this limitation of price, only small quantities of alcohol were sold for motor fuel purposes. It was only when this restriction on the price of alcohol was removed by a decree of 9 September, 1933, that the possibility of disposing of large quantities of alcohol for motor fuel purposes had any attraction for the alcohol producers.

After long negotiations between the government and the Austrian petroleum refineries, the law of 7 July, 1934, regulating the compulsory sale of alcohol for these purposes, came into effect. This imposes upon the gasoline importers the obligation to take up 2 percent by weight alcohol for all gasoline imported, while domestic refineries which produce gasoline must take up 3.75 percent. Alcohol for mixing purposes must have a purity of 99.5 percent; the mixture must be of at least 20 percent alcohol, but must not exceed 40 percent alcohol. The price of the alcohol is 0.80 schilling per litre and the mixture is exempted from the gasoline taxes. The sales of motor alcohol in 1935 amounted to 4,400 tons. The cost of the mixture is borne by the consumers, the distributing companies, and the state. The cost of alcohol amounts to Austrian Schillings 104.33 per 100 kg. as compared with Sch. 59.05 for gasoline or an excess of Sch. 45.28 per 100 kg., while the state loses Sch. 50.87 in duties and taxes on 100 kg. of gasoline replaced by alcohol.

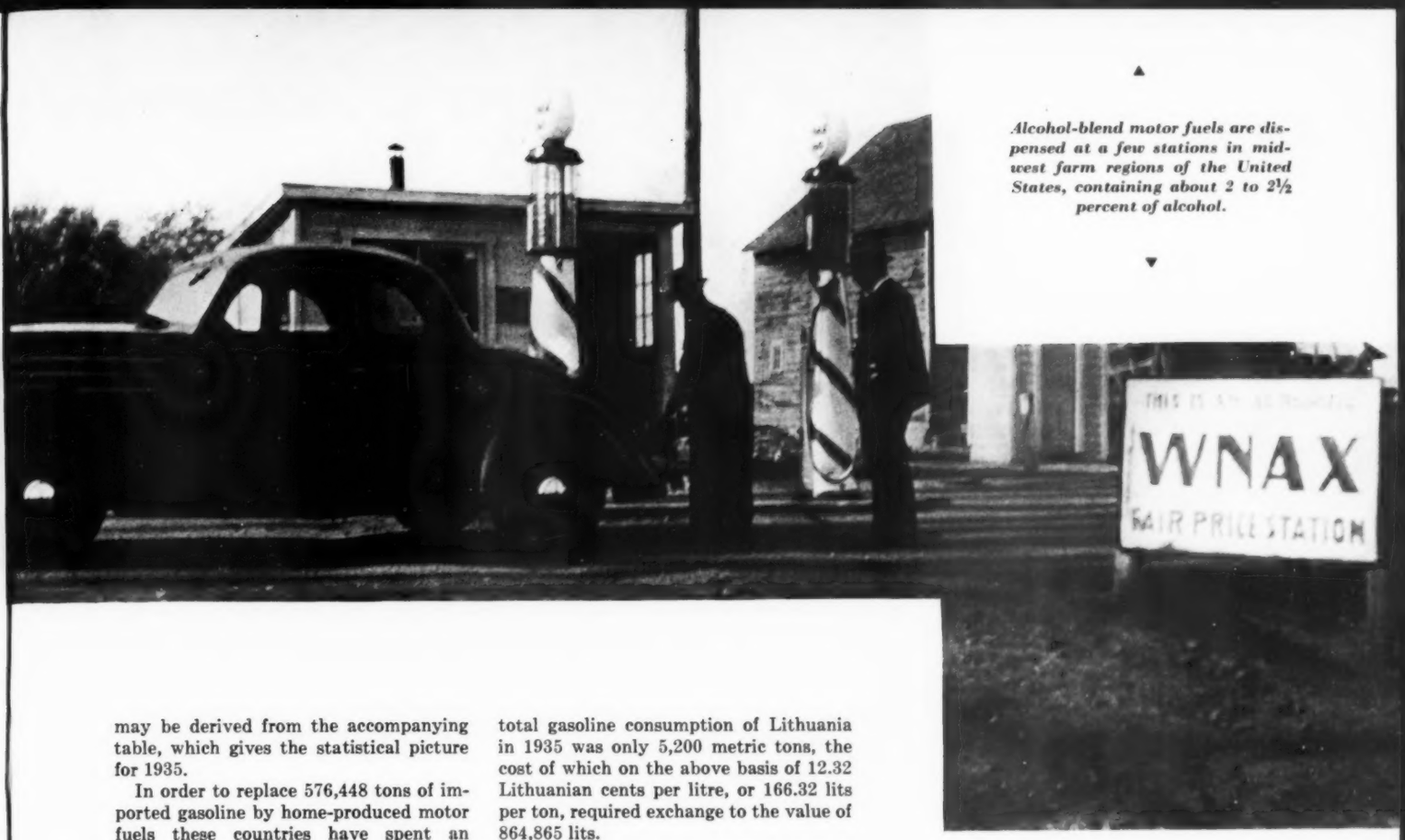
Annual Cost Over $150,000,000

THE AFOREMENTIONED eleven countries form the major part of Europe, which, up to 1935, had introduced compulsory alcohol admixture in one form or another. What it meant to those countries, both financially and economically,

Use of Fuel Alcohol in European Countries, 1935

Country	Quantity Consumed Metric Tons	Price of Alcohol per hectolitre	Price of Alcohol Cents per gallon	Number of Motor Vehicles	Cost per car	Total cost of alcohol fuel to country*
Austria	4,400	Sch. 80	57	45,000	$17.50	$ 793,000
Czechoslovakia	42,477	Kc. 486.50	76	90,000	61.66	5,549,800
France	293,600	Frs. 105.54	27	2,182,000	35.50	77,529,000
Germany	180,000	RM. 50	76	1,104,000	55.87	61,688,000
Hungary	8,731	Pengoes 70	79	15,200	136.30	2,072,000
Italy	5,000	Lire 290	88	392,000	4.00	1,577,000
Jugoslavia	6,592	Dinars 461	40	10,400	21.83	227,000
Latvia	5,457	Lats 48	59	3,950	356.	1,408,000
Poland	5,941	Zl. 26	19	25,200	33.73	851,000
Spain	12,000	Ptas. 100	52	179,500	1.13	204,000
Sweden	12,250	Kr. 32	31	154,800	6.37	986,000
Total	576,448			4,202,050	36.38	$152,884,800

* Including (a) Direct loss to government on sale of alcohol below cost.
(b) Loss of customs revenue on displaced gasoline.
(c) Addition to cost of gasoline owing to inclusion of alcohol.



Alcohol-blend motor fuels are dispensed at a few stations in midwest farm regions of the United States, containing about 2 to 2½ percent of alcohol.

may be derived from the accompanying table, which gives the statistical picture for 1935.

In order to replace 576,448 tons of imported gasoline by home-produced motor fuels these countries have spent an amount of $152,884,800 for what might have been available at a cost of some $12,970,000, taking a c.i.f. gasoline price of $22.50 per metric ton as a fair average for most European countries.

Further comment seems hardly necessary. Although these figures reflect only one small section of the economic life of these countries, they are symptomatic of the degree to which economic considerations have been banned from their trade policies.

This, however, does not mean that the alcohol movement has reached its climax. On the contrary, the list of countries in which the use of alcohol is being agitated is still growing, and it would be rash to assume that an end is yet in sight.

Although the results obtained have been so unsatisfactory, a further addition to the list of alcohol countries has quite recently been made by Lithuania.

Efforts by the agrarian interests in Lithuania, continued for many years, recently attained their object. On 1 April, 1936, the law enacted last year to introduce compulsory alcohol mixtures came into effect. It provides for a mixture of 25 percent alcohol and 75 percent gasoline, and includes also gas oil, the price to be paid for the alcohol being 95 Lithuanian cents per litre f.o.r. Freight charges raise the price to 99 Lithuanian cents per litre, whereas the c.i.f. price of gasoline is 12.32 Lithuanian cents. The total gasoline consumption of Lithuania in 1935 was only 5,200 metric tons, the cost of which on the above basis of 12.32 Lithuanian cents per litre, or 166.32 lits per ton, required exchange to the value of 864,865 lits.

As the gasoline taxes amount to 52.50 Lithuanian cents per litre (33.4 cents per gallon) the state loses through compulsory mixing, on the basis of last year's gasoline consumption, 935,000 lits annually. That is not, however, the whole loss. As the cost of the mixture is 73.37 Lithuanian cents, while pure gasoline costs only 64.82 Lithuanian cents (c.i.f. price plus import duty), additional costs for mixing and trading not being included, there is a further loss of 600,000 lits ($100,883), making a total of 1,535,000 lits $258,092).

When it is considered that Lithuania is a country with an area of 55,700 sq. kilometres, with a population of 2,470,000 and a total of 1,943 motor vehicles, such a loss appears considerable.

As regards other European countries, the question of compulsory admixture is on the legislative program only in Switzerland. Although the difficulties which have arisen there are largely the result of the policy of the Alcohol Monopoly itself in encouraging unnecessary imports of alcohol, it appears likely that the producing interests concerned, which are principally the fruit farmers, may succeed in attaining their object.

In Holland, as mentioned elsewhere, a similar project has been long under discussion, but the government has hitherto not seen its way to face the loss which alcohol mixing would involve. On similar grounds, Belgium has so far energetically withstood the efforts of the distilling industry to secure a 10 percent compulsory admixture of alcohol in motor fuel.

Great Britain is probably the only country which has hitherto remained free from the alcohol virus. The proposal to introduce compulsory mixtures is not regarded seriously in any quarter, but there is a regular market for alcohol mixtures, although on a very modest scale, encouraged by a government preference on the alcohol to the full extent of the import duty on gasoline, 8d. per imperial gallon (13.75 cents per American gallon).

Only in two European countries has the government had the courage categorically to refuse to introduce compulsory mixing, on the ground of its extravagant violation of economic principles: Luxembourg and Finland.

In Luxembourg a ministerial arrêté dated 17 September, 1934, set up a committee to investigate the possibility of compulsory sales of alcohol for motor fuel purposes. The end proposed was the reduction of the surplus stocks of rye. In February, 1935, the committee made its report, signed by four out of six members, the former including the three official members. The proposal was rejected on the ground that the price of dehydrated alcohol was 2½ times as great as that of

duty-paid imported gasoline and that the treasury would suffer a loss of 2,750,000 francs per annum, while additional payment by the consumer would amount to 6,100,000 francs. The total loss would thus amount to 8,850,000 francs.

The report also pointed out that to say that the remedy for the existence of surplus crops, brought about by the subsidy to agriculture, was the subsidizing of the production of alcohol from this surplus was to argue in a vicious circle. The proper remedy was to reduce the area under the crops to the extent necessary to correct the excess production. The liquidation of existing stocks could then be effected and the producers be fully covered against loss at a greatly lower cost than if compulsory use of alcohol fuel was adopted.

This clear, self-evident and irrefutable logic has also led the government of Finland to refuse to introduce compulsory admixture.

In 1934 the Finnish government appointed a committee to investigate questions relating to motor fuel supply in Finland. This committee, which completed its work last summer, suggested the foundation of an official fuel department and the introduction of the compulsory admixture of sulphite alcohol with gasoline. A committee consisting of representatives of the Finnish Automobile Club, the Motor Distributors' Association, and other organizations in Finland connected with the motor industry and with road transport, prepared a memorandum replying to the suggestions of the government committee.

In their memorandum, the road organizations arrived at conclusions entirely opposed to those of the official committee.

The principal points in this reply were as follows: Whereas the c.i.f. cost of gasoline may be assumed to be Fmk. 0.85 per litre, or 7 cents per gallon, (actually the present price is substantially lower) the cost of alcohol for use as motor fuel would amount to Fmk. 5 per litre (41 cents per gallon). On the assumption that every litre of alcohol used as motor fuel replaces a litre of gasoline, this would involve a loss to the state of Fmk. 1.45, or 3 cents per gallon (the duty on a litre of gasoline) and an extra burden of Fmk. 2.70 (6 cents per gallon) to the consumer per litre of alcohol used. On the basis of an annual production of 5,000,000 litres of sulphite alcohol a year for motor fuel purposes, as suggested by the official committee, this would mean that the consumers would pay Fmk. 13,500,000 ($297,000) a year more than necessary for their motor fuel, while the state would lose Fmk. 7,250,000 ($159,500) of revenue annually.

Referring to the social aspect of compulsory alcohol mixing, the memorandum states that the manufacture of alcohol provides very little additional employment, especially as the plant, and also the fuel, used in manufacturing alcohol has to be imported, whereas the expenditure by the state of the proceeds of the gasoline tax on road building gives direct relief to unemployment, where it is most needed.

Farm Benefit Illusory

WITH REGARD to the claim that compulsory alcohol admixture would benefit the farming classes, certain data are given showing that these benefits would be far less than has been stated. The memorandum shows that, if the whole of the country's output of sulphite alcohol were diverted from its present uses and were set aside for use as motor fuel, so that it had to be replaced for other purposes by alcohol produced from agricultural products, this might benefit the potato growers to the extent of 6,000,000 marks a year. As against this, the agricultural population, which is a great user of motor transport, would bear a good share of the much larger burden (Fmk. 13,500,000 a year) imposed on motor traffic by the high cost of the alcohol blend.

While admitting the importance of alcohol as a war material, the Committee points out that, as a fuel, it is of comparatively little value, particularly as alcohol blends are unsuitable for use in aircraft owing to the tendency to separation. In any case, if the requirements in the event of war are to be the ruling consideration, it would be a simple matter to accumulate reserves of gasoline at least equal to the amount of alcohol that could be produced.

Finally, the Committee points out that, from the defense point of view, the greatest danger does not consist in a possible fuel shortage, but in the fact that excessive taxation in time of peace makes motor fuel so expensive that the public are compelled to buy low-powered vehicles which are economical of fuel, so that cars and lorries of the higher horse-power, desirable for defensive purposes, are no longer being imported.

The Finnish government, finding no answer to these weighty arguments, allowed the alcohol project to lapse.

Those arguments include the essentials of what reasonable men can oppose to the alcohol mania which characterizes Europe to-day. What is there said leads, indeed, to very much the same conclusion as the contention which was put forward again and again in the history of French alcohol policy: namely, that the state would considerably reduce its losses on motor alcohol if it burned the alcohol locally, thus getting from it merely its value as a furnace fuel instead of compelling its use, at vast expense, as a constituent of motor fuel.

In conclusion it may be said that the accumulation of economic losses through the compulsory mixing of alcohol with gasoline is out of all proportion to the advantages derived therefrom by a section of the agricultural population, even in the most favorable circumstances. In sober truth, compulsory alcohol blending stands revealed as an unheard-of-waste, nothing more or less than an unfortunate result of the psychosis of economic nationalism into which the world, and especially old Europe, has lapsed in the post-war years.

Books

WHO'S WHO IN COMMERCE AND INDUSTRY (1936), Institute for Research in Biography, Inc. ($15).

The aim of this work has been to furnish a reference book which would serve as an index to the careers of outstanding industrial and financial executives in the United States and Canada.

The volume contains 6,516 authentic biographical sketches of chairmen of boards, presidents and other important officers of industrial, manufacturing and transportation corporations; executives of utilities, communications and mining companies; heads of insurance companies, financial and investment institutions and banks; merchants of leading department stores and mercantile establishments, and elected officers of important chambers of commerce and national trade associations.

It is believed that this edition may be considered as the first definite, fairly complete record of industrial and financial leaders, practically all biographies having been personally approved by the subjects.

THE Society of Petroleum Geophysicists has started publication of its new quarterly journal GEOPHYSICS ($3 per copy), which will be devoted to general and applied geophysics, with particular emphasis on exploration for petroleum. The editor is F. M. Kannenstine, of Houston, with Dr. L. W. Blau, Dr. E. E. Rosaire, and Miss M. E. Stiles as associate editors.

Vol. I, No. 1, comprises 169 pages of text, consisting of original papers by L. W. Blau, M. M. Slotnick, M. C. Malamphy, C. O. Swanson, F. Rieber, F. A. Tompkins, E. G. Leonardon, H. M. Evjen, C. R. Hrdlicka, E. E. Rosaire and M. E. Stiles, and J. Brian Eby. These papers cover a wide range of important subjects. There is also a summary of geophysical activity reports for 1935 and a book review by John H. Wilson.

Judging from this first number, GEOPHYSICS will prove an indispensable source of information on petroleum prospecting.

A striking night view of the spectacular Ninth International Petroleum Exposition held at Tulsa, Oklahoma, during May.

Ninth Petroleum Exposition Attracts International Group

Delegates From All Over the World Visit Tulsa for Exhibition of Most Modern Oil Field, Pipeline and Refinery Equipment. Next Oil Show Scheduled for May, 1938, to Last Two Weeks.

TULSA, MAY 24

EQUIPMENT valued conservatively at $12,500,000 was being moved from the site of the International Petroleum Exposition this afternoon at the wind-up of the most successful oil show ever held in Tulsa. Some 546 exhibitors, estimated by W. G. Skelly, president of the exposition, to have sold between $10,000,000 and $15,000,000 worth of oil equipment during the show, expressed complete satisfaction with the response obtained from the oil industry to this striking exposition.

Delegates from 13 countries attended the exposition. The international aspect of the exposition is becoming one of its outstanding features. Delegations from Russia, India, Germany, Spain, England, France, Roumania, Greece, Colombia, Venezuela, Mexico and the West Indies were to be seen carefully studying the striking exhibits of the most modern oil industry equipment and supplies. The international visitors were entertained at luncheons and dinners. Following the show, a number of the international visitors took advantage of the opportunity to extend their travels into the neighboring oil country where it was possible to see much of the equipment that had been on exhibition, actually in use in the field.

Following meetings of the Natural Gasoline Association on May 13 and the regular mid-year meeting of the American Petroleum Institute on May 14, the American members of the Institution of Petroleum Technologists, leading British technical society, held their first American meeting in Tulsa and took under consideration a suggestion that they organize a regular American branch of the Institution. A most cordial letter from Sir John Cadman, president of the I.P.T., was read at the meeting and papers were delivered by E. De Golyer and Gustav Egloff.

On Saturday, May 16, the Ninth International Petroleum Exposition formally opened its gates to the oil industry and general public. W. G. Skelly, president of the Skelly Oil Company and president of the Exposition acted as official host on the first day of the exposition. However, it might be said that Mr. Skelly acted the part of a most cordial unofficial host on every day of the exposition. Over 100 international delegates registered during the first few days of the exposition. Oil editors from all over the country attended the show and a number of oil industry pioneers registered at the replica

An air view of the crowded exposition grounds outside of Tulsa during the week of the Ninth International Petroleum Exposition.

of the old Drake well that had been erected on the grounds.

President Skelly defined the purpo e of the oil show as follows:

"It was the purpose of its founders to provide facilities in the heart of the oil country for the exhibition and practical demonstration of improved machinery, devices and methods for the production, manufacture, and utilization of oil and its many products, and to provide a meeting place for the interchange of ideas and the discussion of problems of the petroleum industry.

"In these few short years this exposition has become the clearing house for every phase of the oil industry of America and the world. Its permanent practical value and service to the petroleum industry and to allied industries have amply justified the vision and the faith of its founders and those who have contributed to its success."

Following his address, Mr. Skelly fired five shots from a revolver and an 80 foot American flag was released to float in the breeze between two of the 136 ft. derricks that were on exhibition.

In the evening an oil well fire was staged near the exposition grounds. Connections with a natural gas pipeline were established and the gas was released under a pressure of 125 lbs. The derrick burned down and the burning wreckage was pulled away with hooks. When everything was ready, with flames shooting sixty or eighty feet into the air, Floyd Kinley, famous oil well fire fighter, walked into the blaze clad in an asbestos suit and deposited a pound of nitro-glycerin at the base of the flames. The explosion snuffed out the blaze for a second and the fire was over.

On Tuesday night the international delegates were entertained at a formal dinner by the Tulsa Chamber of Commerce. On Tuesday afternoon many of the international delegates and others attended a seismograph demonstration at Beggs, Oklahoma, not far from Tulsa. The demonstration was staged by the Seismograph Corporation and followed a luncheon given by the Junior Chamber of Commerce. On Wednesday the Independent Petroleum Association of America held meetings at the Mayo Hotel in the afternoon and evening.

While the week of the exposition was crowded with interesting events, the exposition itself was solidly industrial. A number of highly interesting exhibits were on view. In addition to the regular standard oil field equipment there were several recent developments in the oil equipment and supply industry that attracted particular attention.

In closing the show, the managers of the exposition issued a statement in which plans for the next International Petroleum Exposition were revealed. The Tenth Exposition will last two full weeks instead of 10 days, as in the past. New permanent buildings will be added to the exposition grounds and the date is set for May, 1938. Mr. Skelly stated, at the end of the exposition:

"Without a doubt the Ninth Exposition was the largest of all shows thus far held. An estimate of the value of exhibits reveals that more than $12,500,000 worth of equipment was on the grounds. One firm alone had an exhibit valued at

Massive equipment was on display at the Tulsa Oil Show during the week ending May 23. The success of this year's oil show has led the management of the exposition to announce that additional permanent buildings will be erected before the next Exposition in 1938.

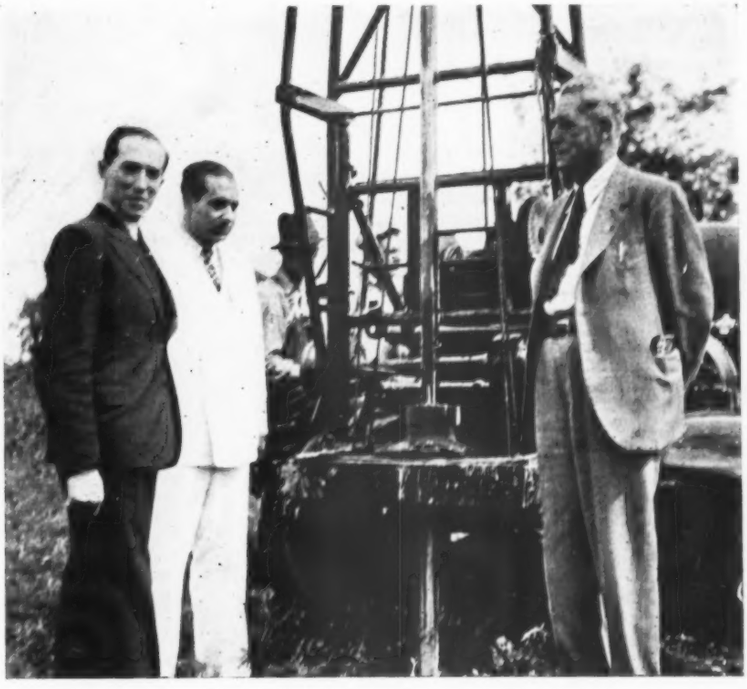
$500,000. There were 546 companies exhibiting and every available inch of the 15 acres which was allotted to exhibit space was taken.

"After all, the criteria of success for the show are the sales made or the contacts made which later result in sales.

"A complete record of sales is not available but a questionnaire sent out to exhibitors, of which a large percentage was returned, reveals the majority made highly satisfactory sales. I hazard a guess that between $10,000,000 and $15,000,000 worth of equipment was actually sold on the grounds during the exposition and that many more millions will be sold because of the contacts made by exhibitors with key oil men. One firm alone sold more than half a million dollars' worth of equipment."

W. A. Irvin, president, United States Steel Corporation, giving the opening address on the first day of the Ninth International Petroleum Exposition. On the left, seated, may be seen E. W. Marland, Governor of Oklahoma.

Delegates of France and Mexico watching the seismograph demonstration at Beggs. From left to right: René Berg and J. N. Chauchat, of Paris, delegates from the Association Française des Techniciens du Petrole; and E. Ordonez, the dean of Mexican geologists, from Mexico City.



Competition Hits British Lube Oil Market

Small Distributors Adopt Gift System to Stimulate Sales—Large Proportion of Trade Carried on Under Contracts—Additional Refinery Capacity Opened.

By Alec H. Day

COMPETITION in the British market for lubricating oils is becoming increasingly keen, and has now reached the stage where some of the smallest distributors have adopted a gift system to stimulate sales. This practice is similar to that formerly used in England in the tea packet and cigarette trades, and still used extensively in the distribution of breakfast foods and like products. It goes without saying that methods of this kind are not resorted to by lubricating oil distributors of any importance, but the struggle for business between the big companies and the numerous importing, blending and marketing concerns in Britain is nevertheless severe, and sometimes desperate.

Comparison of imports and consumption over recent years suggests, however, that the market is by no means unhealthy. Official figures since 1933 are as follows:

	Imports bbl.	Consumption bbl.	Excess or Deficit bbl.
1933.....	2,930,000	2,202,000	+728,000
1934.....	2,954,000	3,286,000	−332,000
1935.....	2,872,000	3,437,000	−565,000
Total.....	8,756,000	8,925,000	−169,000

These figures indicate that while the total imports and consumption for the past three years have practically balanced, there was an excess of imports of 728,000 bbl. in 1933, which has been largely corrected during the succeeding two years.

An official estimate of British production of lubricating oil during 1934 puts the total, including production from shale, at 705,000 bbl. No similar figure has been published for 1935, but the output was probably larger than in 1934. It is likely that during 1933–35, British lube production from petroleum alone balanced exports and also accounted for the import deficit of 169,000 barrels. On this basis, however, there would have been a moderate addition to existing stocks of lubricating oils during 1933, and small withdrawals from stocks during 1934 and 1935.

This evidence that the market is sound from a broad statistical standpoint cannot be taken at its face value, for the developments of the past twelve months and reports from distributing interests all suggest that competition is even keener than before, and still growing in intensity.

Within recent years competition for lubricating oil business between the major interests in Britain has been centered mainly around packaging. As far as motor oil is concerned, this was exemplified in the introduction in 1933 of the bottle as a container by the Anglo-American Oil Company.

The advent of the solvent-extraction process is likely to be one of the main features of the market in the immediate future. Solvent-extracted lubricating oils have already been introduced on the British market by the Vacuum Company. Recently Herbert Green & Company announced the opening of their new plant at Lincolnshire (40,000 tons annual capacity), though partial operation has been proceeding since last November. In the early summer the new Shell plant at Shell-Haven will start production of lubricants for which the British market is the obvious outlet.

Aside from the actual competition which new production of high-class lubricants may bring into the market, solvent-extraction process developments may call for the construction of similar plants by those not already possessing them, and will thus present the big companies distributing in Britain with a new set of refinery problems.

Meanwhile, the keen competition which has existed in the market for many years has arrived at a state where price-cutting has become prevalent, particularly in the smaller type of business, which handles a considerable proportion of the whole market turnover.

In the past year or so the number of small firms handling lubricating oil has been considerably increased by the entrance into the market of men with experience in lubricating oil, but with no means of utilizing that experience except by setting themselves up in business. New concerns of this type, with but small capital, have been eking out an existence by selling lubricants at cut prices, and a number of them have even gone to the length of presenting buyers with oil-sprayers, fancy goods and other articles as an additional inducement to purchase. Such firms obtain their supplies as they are able from importers and merchants, and also buy from the wholesale departments of the big oil companies, apparently making a bare profit on their sales by a judicious "blending" of the varied and partly inferior products which come into their hands. Their selling market is also determined by the exigencies of the moment, and is largely composed of small industrial undertakings, garages, and shops.

Private motorists are estimated to consume between 10 and 20 percent of the total British consumption of lubricating oil, and the demand from this quarter is satisfied almost entirely through garages and filling stations, who draw their supplies mainly from the biggest importers and blenders. This part of the lubricating oil business is probably as remunerative as any. Motorists demand a high-class product, which they take in small quantities, and for which they pay a relatively high price. The new entrants into the lubricating oil trade are said to be making a bid, in their small way, for business directly with private car owners in the districts in which they have established themselves, to the annoyance of companies indirectly supplying high quality motor oil to car owners.

One important section of the British lubricating oil trade in which the small independent is not likely to find a place is the supply of lubricants under big contracts between distributor and consumer. This type of business probably accounts for well over 50 percent of the total, and the small merchant has neither the capital nor the storage facilities for handling this class of business. It is in the less important directions that the new type of competition is having its principal effect. The amount of business which small jobbers are able to take from larger concerns is relatively light, but their presence in an already highly competitive

market is a factor tending to keep prices at an unremunerative level.

There is thus some resemblance between the position in the British lubricating oil trade and that which has existed in the motor spirit trade for many years, and is still probably one of the impediments to higher prices. The lubricating oil position, however, is less serious than that in motor spirit to the extent that lubricating oil is an extremely diversified trade, and the substantial distributor offering a wide range of products always stands at a big advantage in competition with the small trader possessing only a limited variety of goods to sell. In addition, the larger proportion of total consumption delivered under big contracts prevents any considerable inroads into the total business by irresponsible distributors. An annual turnover of from 200 to 1,000 bbl. is said to be the turnover of some of the smallest lubricating oil concerns, and the distribution of this quantity at cut prices can hardly provide bread and butter for the principals, however light their overheads may be. There is, in fact, evidence that many of the men at present engaged in this class of distribution would be glad of an opportunity to quit trading on their own account, and to take up less precarious employment in the oil distributing industry.

Unfortunately, the unreasonable measure of competition which has developed at the least important end of the bulk distribution of lubricants, is symptomatic of the conditions prevailing in practically every section of the business. Among the large number of importers, merchants and blenders, some of which were established as lubricant distributors before petroleum was discovered, price cutting has rendered a large proportion of the trade unremunerative, and the same conditions seem to apply to the operations of the big importing and distributing companies.

With conditions showing signs of becoming worse rather than better, in spite of the rising trend of demand, it is no cause for surprise that renewed efforts are being made in various directions to get the general level of prices on a more remunerative basis. The very diversity of lubricating oils obviously presents a powerful impediment to the successful operation of price-fixing agreements, but there is no question that steps to improve the position of the trade by the restriction of competition are long overdue.

▼

Kirkuk Refinery to Stimulate Motoring

By A. E. Mulford

A RESTRAINT to the more extensive development of road transport and the automotive industry of the Fast undoubtedly has been the high retail price of petroleum. Its import into Palestine bears a duty equivalent to just over 100 percent above the rate charged by the vending companies. The current tariff price of petrol in Palestine is $1.87½ per four gallons when supplied from filling-pumps, with an additional five-cent charge when supplied in tins. On this price the Palestine Government tax is one dollar per four gallons.

To a certain extent, motorists are compensated by the low automobile registration fees, which range from $10 a year for private vehicles or taxicabs to $60 for omnibuses, and somewhat more for commercial vehicles, depending upon their gross weight. Yet even so, motoring is still in its infancy in Palestine, in spite of excellent highways and remains a luxury to many of the inhabitants.

With the laying of the pipeline from Iraq to the Mediterranean coast, and the start of crude oil exports by the Iraq Petroleum Company, it was generally believed that an era of broader local progress would be initiated. According to the first reports, the I.P.C. had intended setting up a refinery at Haifa with the object of supplying regional needs, but, up to the present, nothing further has been heard of the rumored scheme.

By means of a quota supply arrangement or other agreement with existing companies enabling them (on a proportional basis of present sales) to continue their marketing activity, a local refinery might be able to produce petrol at a much lower initial price, with resultant increases in sales.

An authoritative message from Baghdad to the WORLD PETROLEUM correspondent in Jerusalem now shows that an oil refinery at Kirkuk, site of the Iraq oilfields, has been entered as one of the principal schemes under the kingdom's Five Year Plan. The purpose of the refinery, which will be constructed near the railroad depot, is to supply Iraq's oil requirements.

Preliminary investigations will be undertaken in the near future, and the Iraq Council of Ministers has voted an appropriation of $10,000 to cover the expenditure of this inquiry. This will include the fee of an expert oilman, and it is understood that an American engineer will be employed. The cost of building and equipping the refinery will be met by the Iraq Treasury out of state funds.

No doubt this development in Iraq will be followed by a similar scheme for Palestine and Syria, thus furnishing the East with an abundant petrol supply at a moderate cost, and stimulating the latent automotive industry which can prove so great a factor in general progress.

Another aspect of the advance made by the Iraq Petroleum Company is to be seen in the construction of new storage tanks in Haifa harbor. The ten crude-oil reservoirs which hitherto stored petroleum reaching the harbor by the trans-desert pipeline have turned out to be too small, although each of them has a capacity of 12,000 tons. Construction of seven more tanks has been undertaken within the last year, three of which are now ready and the other four almost completed.

As tankers reach Haifa irregularly, it has proved necessary to erect more tanks in order to provide more flexibility in operation. During 1935, when output at the oilfields was over 3,500,000 tons, the flow to the coast terminals had to be slowed down, and even halted on occasions, as the existing tanks were inadequate for storage of incoming crude.

The total number of tanks available will now be seventeen, with over 250,000 tons storage capacity. Nevertheless, it is believed that these, too, will prove insufficient, and plans for further additional tanks are now being considered in order to ensure the continuous functioning of the Kirkuk-Haifa section of the line.

Soviets Plan 100,000,000 Rbl. Oil Investment

Capitalization and Capital Investments of Soviet Oil Industry—Exploration and Geological Research, Long Neglected, Now Being Emphasized.

By J. Wegrin

DURING the first Piatiletka and the following two years of the second Piatiletka, over 2,000,000,000 Rbl. were invested in Soviet oil, and today the total assets of the Soviet oil industry represent a value of over 2,500,000,000 Rbl. distributed almost equally between working capital and all other assets.

During the first Piatiletka period the sum of 1,500,000,000 Rbl. was invested, of which 850,000,000 Rbl. or slightly less than 25 percent of the total capitalization was used for building and erections, 30 percent of which remained uncompleted at the end of the first Piatiletka. During the eight years preceding the first Piatiletka (1920–1928 or the first reconstruction period) about 450,000,000 Rbl. was invested in building and erections of which almost 50 percent remained uncompleted at the end of 1928.

The total capitalization of the Russian oil industry in pre-nationalization days was estimated at 700,000,000 Rbl. or less than ⅓ of the investments made by the Soviets between 1920 and 1934, or about ½ of the Soviet investments in oil carried during the period of the first Piatiletka. Between 1920 and 1924 the Russians had taken inventory of what was left of the pre-war oil industry and in 1924 they undertook the actual reconstruction in the form of Americanization of all field operations. Free fall and cable drilling were replaced by rotary methods; bailing of oil was dispensed with and replaced by mechanized means, such as compressors and pumping. Modern rigging, capping of wells, gas trapping and many other American innovations were introduced and all operations were electrified. This reconstruction was completed before the beginning of the first Piatiletka in 1928, and it looked as if, with a corresponding reconstruction of refining, transportation and storage, the Soviet oil industry would represent a more or less modernized organization. Notwithstanding the reconstruction of the producing end of the industry, however, shortcomings in this division continued, particularly in drilling. The speed of drilling was low, operations were far from satisfactory and deep drilling was an unknown factor in Soviet oil fields. Soviet oil officials have admitted on several occasions that these failures constitute a dangerous obstacle to the progress of the industry during the entire period of the Five Year Plan, and some of the major shortcomings are hindering progress even today.

Between 1929 and 1932 reconstruction was carried into the refining, transportation and storage divisions. This reconstruction was more effective than the reconstruction of drilling and production. It has contributed in a large measure to wipe out the arrears of the oil industry, but here again many mistakes were made which showed up during the first years of the second Piatiletka. However, while up to 1928 almost all heavy crude and some light grades could not be run to stills, owing to lack of refining facilities, the Soviet oil industry in 1932 was in a position to refine practically all grades of crude. All old shell stills were modernized, new shell stills erected, pipe stills installed and pipelines laid to meet the demands for exports, as well as for some of the requirements of internal consumption at that time.

During these years of reconstruction, practically no attention was given to exploration of new oil lands required to replace the exhausted regions. Meanwhile the demands for oil were constantly increasing. Ambitious plans were made for the industrialization of the country at large and for mechanization of agriculture, transportation and aviation. The plans for crude production, in order to meet the ever-growing demand, were repeatedly revised and enlarged, but prospecting and exploration was practically entirely neglected. Flowing wells at Baku, Grozni, Maikop, Middleasia and elsewhere made the Soviets confident that they could indefinitely take care of all planned industrial expansions. Not until the catastrophic collapse of production at Grozni did the Soviets awaken to the immediate necessity of searching for new oil lands.

Before the expiration of the first Piatiletka the Soviets had decided, or owing to fiscal reasons were compelled to decide, to discontinue importation of oil equipment from abroad. The domestic machine shops were not, as yet, prepared to manufacture specialized tools and equipment of high quality, at least not for immediate delivery. The combined resources of the Soviet domestic machine industries were unprepared for the task and besides the Soviet engineering minds lacked the experience of designing and building high quality equipment. As a result there were frequent breakdowns at wells, flowing wells failed to come in as often as expected, and plans and schedules failed to materialize.

High officials of the Soviet oil industry and the Communist Party often asserted that failure of the plans was due primarily to defective supervision, inefficient management or inability to concentrate the resources of labor, supplies and equipment upon the objective possibilities at disposal. They were well aware of the shortcomings which caused such failures and knew the reasons for the growth of labor liquidity and the diminution of labor productivity, but they had entirely overlooked the urgent necessity of new exploration. Only since Joseph Stalin decreed the creation of a new oil base in the eastern regions of the country has exploration and prospecting come to the fore.

Capital Investment in Soviet Oil

1927	191,000,000 Rbl.
1928	210,000,000
1929	245,000,000
1930	365,000,000
1931	415,000,000
1932	375,000,000
1933	405,000,000
1934	450,000,000
1935	820,000,000
1936 (Plan)	100,000,000

Over 50 percent of the investments for oil in 1928 were applied to oil field operations in connection with changing all drilling from old methods to rotary drilling. Other divisions were almost entirely overlooked, owing to lack of appropria-

tions, as the Soviets had begun the reconstruction of other industries such as coal, metals, machine building, chemicals, etc.

Between 1927 and 1929 Soviet yearly investments in oil amounted to 17.5, 16.5 and 14.5 percent, respectively, of the total industrial investments. In 1929 capital investment in oil was increased 50 percent over 1927, and the results were evident by an increase of 37 percent in crude production and about 50 percent in runs to stills. However, the ratio in percent to all Soviet industrial investments fell to 12 percent, while the other industries (pipe, metals, tools) had but little progress to show in connection with the improvement of supplies to the oil industry.

In 1931 investments in oil were increased 15 percent over the previous year. Production and runs to stills further increased to 22 and 23 percent respectively, but the ratio in percent to all industrial investments fell to eight percent. In 1932 it fell to five percent and reduced rates were carried during the following years. The total sum for investments allotted to oil during the first Piatiletka amounted to almost 1,500,000,000 Rbl., of which only 850,000,000 Rbl. were used.

Crude production became stabilized. Grozni production decreased, leaving only Emba and Baku to meet the demands. During all these years prospecting remained behind all other operations and the increased allotments for this division since 1930 have been insufficient to carry on the work so long neglected. In 1931 drilling conditions became increasingly difficult. All old and new fields required deep drilling and many difficulties were encountered. In 1932 about 11 percent of all drilling expenses were allotted for exploration. They were used mostly for operations in the Caucasus and resulted in the discoveries of Kala, Lokbatan and Artema, at Baku, and Molgabek at Grozni, but no discoveries were reported from the other Soviet oil regions.

Over one-third of all investments during the Piatiletka were spent for refining, transportation and storage facilities, and about two-thirds for development and production, of which 22 percent was spent for the development of new areas and new horizons in the old fields. These operations and the contouring of new areas for commercial production entailed the following expenditures: 66,200,000 Rbl. in 1929, 71,800,000 Rbl. in 1930, 88,700,000 Rbl. in 1931, and 96,500,000 Rbl. in 1932. The corresponding sum for 1933 was approximately 100,000,000 Rbl. The rate of drilling for each 100 tons of crude produced in 1929 was 36.5 feet. This rate decreased to 25 feet in 1930 and 17.25 feet in 1932 and the effects upon crude production were only too plainly evident.

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Soviet oil tank-car train on the Suramsk Divide, not far from Tiflis. This divide, noted for its unusually steep grade, is entirely electrified.

Rbl. 302,000,000 were invested during the first Piatiletka in refinery building. The ratio of expenditures for refinery facilities in percent to the total oil expenditures jumped from 15 percent in 1929 to 22 percent in 1932, but a large proportion of the expenditures was spent at Grozni, where over 84,000,000 bbl. of refining capacities were erected (about five times the pre-Piatiletka capacities). Meanwhile, Grozni production fell to about 25 percent of the 1931 peak of 64,000,000 bbl.

As was explained in the December, 1935, issue of WORLD PETROLEUM, after the collapse of Grozni production (Grozni crude contains up to 24 percent gasoline), Baku crude was shipped to Grozni in order to keep the refineries there on stream. The Baku crude, which normally contains about four percent gasoline, yielded only two or three percent gasoline when refined at Grozni. Naturally, under these conditions, the Soviets had a difficult enough time obtaining sufficient gasoline for domestic use, let alone for export purposes.

The reconstruction of Baku refineries had been retarded. In 1929 only 75 percent of Baku crude could be run to stills owing to lack of facilities. During the Piatiletka new refining facilities of about 7,000,000 tons capacity were erected at Baku. This has doubled the total to about 13,500,000 tons. However, Baku is almost certain to produce 22,000,000 tons of crude in 1936.

About 100,000,000 Rbl. were spent for the erection of refineries at new points such as Saratoff, Gorki, Khabarovsk and Moscow.

Pipeline construction for export requirements was successfully completed before the Piatiletka period, although the Batum refining capacity exceeds the carrying capacity of the Baku-Batum pipelines, and the Grozni-Tuapse pipeline is of little help for exports. However, the line Grozni Armavir Ukraine is the first link to connect production with the large centers of consumption.

The Caspi-Orsk pipeline, now completed, opened the flow of Emba and Baku oil to the Soviet cotton belt and other industrial centers of the East. Total pipeline construction expenditures during the first Piatiletka were 105,000,000 Rbl., which together with previous expenditures for pipeline building brings the total sum to about 200,000,000 Rbl.

British Oil Imports Sag

DUE mainly to lower receipts of motor spirit from Iran and the United States, imports of oil into Britain during the month of April dropped considerably as compared with April, 1935. The figures further establish Iran as the principal supplier of crude. Owing to the April decrease, imports of crude and products for the first four months of this year are less than two percent above total import figures for the first four months of 1935, although small increases were registered in all categories except fuel oil.

British Oil Imports by Products

(Bbl.)

	April 1936	4 months to Apr. 30, 1936	4 months to Apr. 30, 1935
Kerosene	531,456	2,098,656	2,089,914
Motor spirit	3,242,685	12,210,743	11,979,543
Lubricating oil	379,573	1,207,915	953,458
Gas oil	407,913	1,234,143	1,145,770
Fuel oil	1,583,629	5,519,456	5,677,088
Other sorts	80,459	177,173	201,684
Total products	6,225,715	22,448,086	22,047,457
Crude	1,091,857	4,385,743	4,278,628
Total imports	7,317,572	26,833,829	26,326,085

Foreign Oil Legion

René Berg of Premafu, Paris, has been spending several weeks in the United States including a visit to the Tulsa Exposition. As the official representative of L'Association Française des Techniciens du Petrole M. Berg has been engaged in extending to petroleum associations and other interests an invitation to participate in the World Petroleum Congress to be held in Paris in 1937.

René Berg

Following the completion of arrangements by Socony-Vacuum and The Texas Corporation for the purchase of the South American Gulf Oil Company, which controls the Colombian Petroleum Company, owner of the Barco concession, the following were elected directors of South American Gulf Oil:

From Socony-Vacuum, J. A. Brown, A. F. Corwin, H. F. Sheets, and G. V. Holton. From The Texas Corporation, T. Rieber, W. S. S. Rodgers, H. T. Klein, and R. Ogarrio were elected. These men were also elected directors of Colombian Petroleum Company, with the addition of Charles F. French and Harold J. Wasson representing the Carib Syndicate, Ltd.

The following officers of the South American company were then elected: John A. Brown, chairman; T. Rieber, president; A. F. Corwin, R. Ogarrio, and W. S. S. Rodgers, vice-presidents.

Officers of Colombian Petroleum Company were elected as follows: A. F. Corwin, chairman; R. Ogarrio, president; R. F. Baker and George E. Dorsey, vice-presidents.

Capt. M. Stuckey and Mrs. Stuckey, who have been spending a brief vacation in the United States, sailed on the Normandie, May 12. They are returning to Haifa where Capt. Stuckey is in charge of the operation of the Iraq pipeline, which was constructed under his direct supervision.

Listed among the passengers of the Zeppelin Hindenburg on its maiden voyage from Friedrichshafen to Lakehurst, N. J., was A. Ernst, representative in Hamburg of the Tidewater Oil Company. Captain Thorkild Rieber, of The Texas Corporation, and Ben Smith, prominent oil investor, were passengers on the air-

Ralph Hague

ship's return flight to its home port. Capt. Rieber's trip was in every sense a flying one as he returned to New York May 28 on the Bremen.

Ralph Hague has been named manager of the newly opened eastern and export office of the Bridgeport Machine Company, located in Rockefeller Center, New York. Mr. Hague, who has been with the company for 15 years, has served in various capacities in the Mid-continent fields.

The German delegation at the Tulsa Exposition visits the seismograph demonstration at Beggs, which was one of the features for the entertainment of foreign delegates. From left to right: M. A. Jodiet of Tulsa, an interpreter; Herman Van Rautenkranz whose company, the International Tiefbohr Co. of Celle-Hanover, controls the largest volume of oil production in Germany; Fraulein Margaret Rupper from Breslau, Silesia, and Walter Januscheck of Spinan-(Oder)-Oderhafen, Germany, both with the Silesian Society of Petroleum Companies.

World Oil Production — Official Figures for 1935 and 1936 Revised

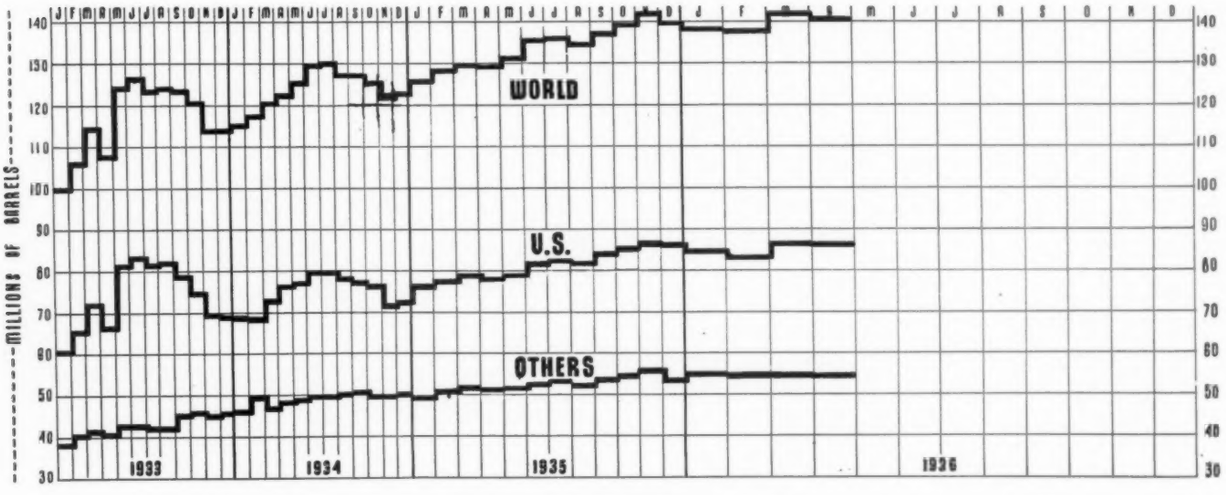
All figures furnished direct to WORLD PETROLEUM by Governments, except where otherwise specified
(Figures in U. S. Barrels—Conversion ratio 7 bbl. = 1 ton)

Country	May 1935	June 1935	July 1935	August 1935	September 1935	October 1935	November 1935	December 1935	January 1936	February 1936	March 1936	Provisional Figures April 1936
United States	82,454,000	82,338,000	85,485,000	84,816,000	84,109,000	88,160,000	86,475,000	88,711,000	88,820,000	82,120,000	90,568,000	87,429,750
Russia	15,248,800	14,232,400	14,777,000	15,091,300	14,849,100	16,040,500	16,050,000[1]	16,100,000[1]	16,500,000[1]	15,400,000[1]	15,940,000[1]	15,100,000
Venezuela	12,175,022	13,075,118	13,429,885	12,628,067	13,151,362	13,681,619	13,152,776	13,389,789	13,487,089	12,849,480	13,432,671	13,442,870
Roumania	5,035,000	4,842,000	5,075,000	5,030,000	4,932,000	5,181,000	5,215,000	5,361,000	5,242,000	4,809,000	5,209,000	5,030,760
Iran[2]	3,927,000	4,200,000	4,249,000	4,634,000	4,270,000	4,109,000	4,522,000	4,816,000	4,627,000	4,480,000	4,641,000	4,532,310
Netherland India	3,517,360	3,463,061	3,531,857	3,699,430	3,661,259	3,767,596	3,528,889	3,612,056	3,614,436	3,407,194	3,670,877	3,532,375
Mexico	3,529,659	3,453,871	3,573,632	3,570,908	3,442,259	3,461,457	3,340,713	3,666,265	3,377,302	3,285,965	3,542,088	2,997,883
Iraq	2,034,753	1,993,586	2,445,625	2,166,794	1,962,541	2,374,393	2,309,867	2,240,819	2,327,332	2,107,210	2,515,345	2,048,053
Colombia[4]	1,486,896	1,518,460	1,639,054	1,576,307	1,555,676	1,623,372	1,582,952	1,004,474	1,611,618	1,475,403	1,619,620	1,427,193
Peru[5]	1,451,436	1,414,588	1,448,225	1,442,565	1,448,133	1,493,236	1,343,848	1,381,031	1,377,006	1,293,627	1,351,810	1,403,626
Argentina	1,203,017	1,161,638	1,198,550	1,198,537	1,152,919	1,200,698	1,193,434	1,304,554	1,310,129	1,273,243	1,194,988[1]	1,156,440
Trinidad	953,108	972,904	988,341	1,003,382	992,445	1,015,492	1,078,957	1,086,530	1,079,082	983,424	1,081,191	1,026,423
British India	794,968	768,692	791,774	796,150	775,133	790,612	649,041	841,764	760,182[1]	711,138[1]	760,182[1]	735,660
Poland	301,000	294,000	308,000	315,000	301,000	308,000	294,000	308,000	308,000	294,000	308,000	294,000
Brunei	277,550	269,290	283,430	281,400	256,480	233,310	242,900	274,540	253,400	237,930	257,250	270,900
Germany	285,747[3]	257,369[3]	276,990[3]	241,801[3]	229,712[3]	232,659	236,789	263,879	254,492	227,444	274,393	246,519
Japan	154,150	144,160	146,863	152,290	144,312	158,165	145,749	147,827	183,651	165,877	196,569	186,131
Sarawak	155,400	150,850	151,830	154,000	145,600	148,400	141,400	140,700	139,300	127,050	136,290	130,900
Ecuador	147,245	137,806	144,812	135,549	138,986	147,449	143,518	146,541	148,980	139,374[1]	162,125	159,666
Canada	123,801	120,102	118,812	117,652	123,919	122,525	116,756	125,658	121,231	107,928	117,824	117,570
Egypt	100,555	99,270	103,488	104,937	100,954	103,341	96,495	94,969	91,497	97,573	111,846	101,038
France	46,991	46,000	45,276	46,312	43,530[1]	44,981[1]	43,530[1]	44,981[1]	44,981[1]	42,079[1]	44,981[1]	43,530
Others[1]	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000
Total	135,478,458	135,028,155	140,287,444	139,268,381	137,861,320	144,472,805	141,978,614	145,137,377	145,753,708	135,709,939	147,211,050	141,488,597

[1] Estimate. [2] Anglo-Iranian Oil Co. figures revised; fuel oil returned to the ground has been deducted. [3] Thuringia estimated 7,000 bbl.; official figure for Prussia. [4] International Petroleum Company's figures. [5] International Petroleum Company and Lobitos Oilfields Ltd. figures.
Russian Sakhalin included with Russia. Japanese Sakhalin included with Japan.

Official Crude Oil Production Figures for 1932 to 1936

	Total 1936	Daily Average 1936	Total 1935	Daily Average 1935	Total 1934	Daily Average 1934	Total 1933	Daily Average 1933	Total 1932	Daily Average 1932
United States	348,937,750	2,883,783	993,942,000	2,723,129	909,107,000	2,490,704	898,874,000	2,462,670	785,159,000	2,145,243
Russia	62,940,000	520,165	176,688,100	469,608	168,648,700	462,051	149,901,900	407,950	149,719,000	409,070
Venezuela	53,212,110	439,769	152,363,382	417,434	142,072,329	389,239	120,882,802	331,186	119,596,512	326,766
Roumania	20,290,760	167,692	61,150,000	167,534	62,006,000	169,879	50,971,200	139,647	50,491,205	137,954
Iran	18,280,310	151,077	52,413,879	143,600	52,663,782	144,284	49,581,280	135,840	45,122,455	123,285
Netherland India	14,224,882	117,561	42,569,625	116,629	42,289,408	115,861	38,512,663	105,516	39,584,027	108,153
Mexico	13,203,238	109,118	40,234,902	110,233	38,167,022	104,567	33,904,882	92,890	32,802,285	89,624
Iraq	8,997,940	74,363	24,850,924	68,085	7,935,657	21,742	1,200,000	3,288	1,200,000	3,300
Colombia	6,133,834	50,693	17,617,654	49,740	17,340,724	47,509	13,157,127	36,047	16,384,956	44,768
Peru	5,426,069	44,844	16,835,206	46,270	15,936,937	43,663	13,923,281	38,146	9,899,266	26,026
Argentina	4,934,800	40,783	14,317,500	39,226	14,045,652	39,015	13,759,565	38,232	13,166,900	35,975
Trinidad	4,170,120	34,464	11,669,792	31,686	10,894,363	29,847	9,560,039	26,192	10,023,780	27,387
British India	2,967,162	24,522	9,227,496	25,281	8,997,399	24,650	8,721,655	23,893	8,600,312	23,500
Poland	1,204,000	9,950	3,612,000	9,896	3,697,617	10,130	3,858,085	10,570	3,905,230	10,670
Brunei	1,019,480	8,425	3,162,614	8,647	2,673,041	7,323				
Germany	1,002,848	8,288	3,054,023	8,409	2,266,964	6,211	1,712,823	4,692	1,824,019	4,983
Japan	732,228	6,051	1,848,656	5,065	1,484,962	4,068	1,377,761	3,827	1,575,333	4,375
Sarawak	533,540	4,409	1,811,297	5,002	1,948,044	5,337	2,289,472	6,273	2,274,043	6,213
Ecuador	610,145	5,043	1,725,354	4,727	1,655,062	4,534	1,622,624	4,446	1,573,857	4,300
Canada	464,553	3,839	1,434,467	3,930	1,418,810	3,887	1,147,825	3,144	1,054,373	2,880
Egypt	401,954	3,322	1,215,606	3,356	1,479,037	4,052	1,591,495	4,360	1,742,370	4,760
France	175,571	1,451	529,664	1,451	552,000	1,512	552,000	1,515	552,000	1,508
Bahrein			1,264,809	3,465	285,071	781				
Others	300,000	2,479	900,000	2,470	861,000	2,359	432,000	1,184	432,000	1,180
	570,163,294	4,712,091	1,634,438,950	4,464,873	1,508,426,581	4,133,205	1,417,534,479	3,884,022	1,296,682,923	3,544,940



World crude oil production by months, 1933–1936. Chart is weighted to compensate for variation in number of days per month. Ratio of U. S. crude production to world production.

United States

	Daily Crude Oil Production bbl.	Daily Runs to Stills bbl.	Total Motor Fuel Stocks bbl.	Imports for Week bbl.	California Shipments East for Week bbl.
Week ending Apr. 25	2,941,500	2,875,000	72,537,000	1,170,000[2]	430,000
	452,500[1]				
Week ending May 2	2,918,500	2,875,000	73,706,000	963,000[2]	none
	456,000[1]				
Week ending May 9	2,962,500	2,870,000	73,489,000	906,000[2]	258,000
	457,500[1]				
Week ending May 16	3,005,500	2,920,000	72,490,000	1,082,000[2]	308,000
	455,000[1]				
Week ending May 23	3,004,000	2,975,000	72,490,000	1,109,000[2]	151,000
	455,500[1]				

Underlined figures indicate improvement in statistical position—decrease in production, runs to stills, gasoline stocks and imports.

[1] Estimated total production of the East Texas field, official and unreported.

[2] Import figures include all oil imported, for domestic use and in bond for re-export, it being impossible to make the separation in weekly statistics.

Rodessa Under Control

DURING May Rodessa field contributed largely to the fireworks within the oil industry. On the day following the inauguration of the new Governor of Louisiana, the Pelican Oil and Gasoline Company opened wide its 13 wells on the 120-acre Sexton lease and produced for one week, between May 13 and May 20, about 17,000 bbl. per day, instead of the standard allowable of all other companies of 350 bbl. per well per day. The Pelican overproduced under special permit order of Dr. Shaw, director of the minerals division of the Louisiana Department of Conservation. Connected with the overproduction, directly and indirectly were: the East Texas Pipeline Company which moved the oil from Rodessa to Jefferson, Texas; the Texas-Empire Pipe Line Company which was used in transporting the excess crude oil to the Gulf Coast; the railroads which shipped some of the crude; and the Tide Water Oil Company which accepted the deliveries as purchaser for its Bayonne, New Jersey, refinery. The Texas-Empire Pipe Line Company, however, was involved only to the extent that the Tide Water Oil Company owns a one-quarter interest in it.

The favoritism toward one lease in Rodessa field, draining its offsets, naturally aroused wide-spread criticism in the industry and at one time a cut in crude oil prices appeared very probable. It was averted only by the closing in of the Pelican wells and by the cooperative effort of the industry at large. Pelican Oil and Gasoline Company was disposing of its crude oil at 90 cents per barrel for the first 350 bbl. per well and at 80 cents per barrel for the excess above that standard allowable. A huge waste of gas was involved in the overproduction of the Sexton lease, estimated at as high as 200,000,000 cu. ft. per day (a gas/oil ratio of 8,000); the reservoir pressure of the offset leases has declined as much as 150 lbs. within one week; and salt water encroachment was greatly accelerated.

Federal Tender Board at Kilgore brought a suit before the Federal District Court against the companies transporting the excess Rodessa crude oil in interstate commerce, and on May 22 Judge Randolph Bryant granted a temporary restraining order impounding 71,374 bbl. of crude oil produced on the Sexton lease at Nettleton and Sour Lake stations of the Tide Water Pipe Line Company. Subsequently this injunction was made permanent.

On May 30 the Department of Conservation of Louisiana reduced the per well per day allowable of Rodessa field to 275 bbl. (from 350 bbl.) for the month of June, thus suggesting at least some measure of cooperation with other states. The new order does not actually reduce the total production in Rodessa field but rather takes care of new completions.

At the end of May there were in Rodessa field 192 oil wells, 47 drilling operations and 11 derricks rigging up. The field was extended during the month some 4½ miles into Cass County, Texas, by a small 100-barrel per day well of the American Liberty Oil Company, No. 1 Rambo in J. H. Rives Survey, which had a tight section of Young zone from 5,991 ft. to 6,010 ft.

Prices Await Conservation Measures

DURING May the price trend of motor fuel and other petroleum products continued indefinite and weak, influenced primarily by overproduction, large runs to stills and large gasoline stocks, but still anticipating a large increase in domestic gasoline consumption which could cut into the stocks during the coming Summer months and hoping for reduced production and runs to stills.

During May retail prices throughout the United States remained steady and unchanged. Tank wagon/service station motor fuel prices per gallon, regular grade, including all taxes, in representative districts at the end of May were: 14.2/19.2 cents in metropolitan New York; 14.3/17.8 cents in Newark, N. J.; 12.5/16.0 cents in Boston, Mass.; 12.0/15.5 cents in Providence, R. I.; 15.5/17.5 cents in Chicago (up 0.5/0.5 cents per gallon); 17.5/19.5 cents in Ohio; 17.0/18.0 cents in San Francisco; 16.5/17.5 cents in Los Angeles; 15.0/19.0 cents in Oklahoma; 13.5/17.0 cents in Dallas and Fort Worth (off 0.5/1.0 cents per gallon) and 14.0/18.0 cents in Houston, Texas, with third grade gasoline in East Texas area selling at from 12 to 13 cents per gallon at independent service stations; 15.7/17.7 in St. Louis; and 19.5/22.0 cents in Montreal, Canada; all with a 2-cent differential for the premium grade.

Refinery gasoline quotations weakened slightly during early May, declining from 1/8 to ¼ cent per gallon below April. Refinery gasoline was quoted on May 25 at 4⅞–5⅛ cents per gallon for 58–60 U.S.M. grade, 62.9 and below octane rating in Group 3, Oklahoma market, 63.0–67.9 octane rating, U.S.M., regular grade, was quoted at 5½–5¾ cents per gallon; and 68 and above octane rating, U.S.M., was quoted at 6–6¼ cents per gallon. East Texas refinery markets continued firm during May and at the end of that month the third grade gasoline eligible for interstate tenders was quoted at 4⅞ to 5⅛ cents per gallon. On the East Coast at Bayonne, U.S.M. grade, 60.0–64.9 octane rating gasoline declined ¼ of a cent per gallon to 6½ cents per gallon (3.84 cents gold*). Gulf Coast quotations for export also lost about 3/8 of a cent during the last month and on May 25 grade 58–60 U.S.M. was quoted at 5 to 5⅛ cents per gallon (3.02 cents gold*).

Natural gasoline quotations also weakened during May, losing about ¼ cent per gallon. However, a much firmer tone was anticipated in the near future with California inquiries coming to the Mid-Continent area. On May 25, grade 26–70 was quoted at 2¾–3 cents per gallon (1.70 cents gold*) in Oklahoma; at 2½ cents per gallon (1.47 cents gold*) in North Texas; and at 3⅛–3¼ cents per gallon (1.88 cents gold*) in North Louisiana.

Kerosene prices also weakened during May, losing around ¼ cent per gallon. On May 25 grade 41–43 w.w. was quoted at 4⅛–4⅜ cents per gallon in Group 3, Oklahoma market; and at 4⅞ cents per gallon, unchanged, (2.88 cents gold*) on the East Coast at Bayonne. Gulf Coast prices for export remained unchanged, and on May 25 kerosene was quoted at 3⅞ cents per gallon (2.92 cents gold*) for 41–43 p.w. grade, and at 4 cents per gallon (2.36 cents gold*) for 41–43 w.w. grade. On May 25 No. 1 p.w., 38–42 grade furnace oil was quoted at 3⅜–4 cents per gallon, unchanged; and U.G.I. grade gas oil was quoted at 2⅜–2½ cents per gallon, off ⅛ cent per gallon, all in Group 3 Oklahoma market.

Imports and Exports

DURING March of 1936, total gross imports of crude petroleum and all its products into the

*U.S. Dollar at 41 percent discount.

United States amounted to 4,406,000 bbl. (142,000 bbl. per day), as compared with 4,171,000 bbl. (144,000 bbl. per day) imported during February; out of this total during March 2,730,000 bbl. (88,000 bbl. per day) were imported for domestic use and 1,676,000 bbl. (54,000 bbl. per day) were imported in transit, either for refining and re-export or for use in vessels in foreign trade. During the preceding month, February, 2,882,000 bbl. (99,300 bbl. per day) were imported for domestic use and 1,289,000 bbl. (44,400 bbl. per day) were imported in bond as indicated above.

Exports of crude petroleum and all its products during March, 1936, continued at abnormally low levels, reaching but 8,932,000 bbl. (288,000 bbl. per day), as compared with 8,852,000 bbl. (305,500 bbl. per day) exported in February, a decline of 5.73 percent in the daily rate. The March, 1936, exports were 9.28 percent below the shipments of March of 1935, when 9,845,000 bbl. (317,000 bbl. per day) were exported. Exports of crude oil from United States during March of 1936 reached 3,155,000 bbl. (101,600 bbl. per day), as compared with 3,474,000 bbl. (119,800 bbl. per day) shipped in February, 1936, a decrease of 15.2 percent; in March of 1935, 3,281,000 bbl. (105,800 bbl. per day) of crude oil were exported. In March of 1936, crude oil exports constituted 35.3 percent of the total exports of all petroleum products.

During February of 1936, the gross value of exports of crude petroleum and all its products amounted to $16,881,623, as compared with the gross value of all petroleum imports of $2,801,005, leaving, therefore, a favorable balance of $14,080,618. Crude oil led in the value of exports in February of 1936, its exports being valued at $4,200,419; followed by lubricating oils and greases valued in that month at $4,134,127; followed by gasoline and natural gasoline valued at $3,739,486; by fuel or bunker oil for vessels in foreign trade (not included in domestic exports) valued at $2,738,974; by gas and fuel oil valued at $1,553,077; by residual fuel oil valued at $1,087,767; and by kerosene valued at $1,081,504. Of fuel or bunker oil used in vessels in foreign trade, American vessels used 1,338,904 bbl., valued at $1,311,321, while vessels of foreign registry used 1,350,626 bbl., valued at $1,427,653. The above import figures include imports in bond, and after such imports valued at $722,974 are excluded, the net favorable balance for the United States for the month of February, 1936, was $14,803,592.

Crude Production and Runs to Stills Continue Excessive

CRUDE oil and natural gasoline production during April of 1936 continued in excessive and uneconomic volume, reaching an all time record of 3,070,000 bbl. per day. The April, 1936, crude oil and natural gasoline production was 345,000 bbl. per day above the production in April of 1935, an increase of 12.68 percent. The largest proportion of overproduction was derived from Louisiana, which exceeded its quota by 1,493,000 bbl., or by 30.90 percent; California fields overproduced during April 960,000 bbl., or 5.95 percent; Texas overproduced 880,000 bbl. or 2.63 percent. Smaller overproduction was recorded in Oklahoma and Kansas, which exceeded their respective quotas by 730,000 bbl. and 234,000 bbl.

Crude oil runs to stills during April, 1936, averaged about 2,825,000 bbl. per day, 74,000 bbl. per day above the runs to stills during the preceding month when 2,751,000 bbl. were processed per day. Total stocks of all petroleum products increased 5,561,000 bbl. during March, 1936, to a total of 548,805,000 bbl., indicating a daily gross addition to stocks of 185,200 bbl.

Record Motor Fuel Demand

INDICATED domestic demand for motor fuel during March, 1936, averaged 1,157,000 bbl. per day, 22.40 percent above the average during the preceding month, when 945,000 bbl. were consumed per day; the domestic demand during March, 1936, was 119,000 bbl. per day above the domestic motor fuel consumption in March of 1935, a large increase of 11.47 percent; it was also 160,000 bbl. per day above the domestic motor fuel consumption in March of 1934, an increase of 16.05 percent. During March of 1936, 52,000 bbl. of motor fuel per day were exported from the United States, 10.32 percent below the daily motor fuel shipments of the preceding month; 37.9 percent below the motor fuel exports in March of 1935; and 36.5 percent under the motor fuel exports in March of 1934.

On April 1, 1936, motor fuel stocks at refineries, plants, terminals and in transit, inclusive of natural gasoline, amounted to 79,038,000 bbl., an addition to storage of 2,890,000 bbl. as compared with stocks on hand on March 1, 1936, indicating that during March motor fuel supply exceeded demand by 93,200 bbl. per day.

BASIL B. ZAVOICO

Gulf Export Prices for Major Oil Products

Products		Cents per Gallon			
		Apr. 22	Apr. 29	May 6	May 13
Gasoline:	U. S. Motor	5⅛	5⅛	5⅛	5⅛
	64/66–375 E.P.	5¾	5¾	5¾	5¾
	59 Octane & below	5⅝	5⅝	5⅝	5⅝
	65 Octane & above	6⅛	6⅛	6⅛	6⅛
Aviation Gasoline:	73 Octane & above	10	10	10	10
Kerosene:	44 w.w.	4¼	4¼	4¼	4¼
	41–43 w.w.	3⅞	3⅞	3⅞	3⅞
	41–43 p.w.	3⅞	3⅞	3⅞	3⅞
Gasoil:	26–30 translucent	3⅛	3⅛	3⅛	3⅛
	30 plus translucent	3¼	3¼	3¼	3¼
Fuel oil:	Grade C Bunker (per bbl.)	$ .90	$ .90	$ .90	$ .90
	Cargo lots (per bbl.)	$ .80	$ .80	$ .80	$ .80
	Diesel oil (per bbl.)	$1.50	$1.50	$1.50	$1.50
Lubricating Oil: (New York Export Market)	Bright Stock No. 8	26½	27½	28	28
	Bright Stock No. 6½	26	27	27½	27½
	Warren E.	20½	22	22	22
	600 Unfiltered	18½	19	19½	20
	650 Unfiltered	19½	20	20½	21
	600 Flash s.r.	20½	21	21½	22
	650 Flash s.r.	24½	24½	24½	24½
	Neutral 200 No. 3	27	27	27	27
	Neutral 150 No. 3½	23	23	23	23½
So. Texas:	Red oil 300 No. 5–6	7¼	7¼	7¼	7¼
	750	9	9	9	9
	1200	9¼	9¼	9¼	9¼
	Pale oil 500	7⅞	7⅞	7⅞	7⅞
	750	9	9	9	9
	1200	9¼	9¼	9¼	9¼
Crude Oil:	East Texas crude delivered at Gulf port for Export	$1.36	$1.36	$1.36	$1.36
	Venezuela crude	.83	.83	.83	.83
	Trinidad crude	.85	.85	.85	.85
	Panuco crude	.75	.75	.75	.73

Freight Rates

	Apr. 22		Apr. 29		May 6		May 13	
	Dirty	Clean	Dirty	Clean	Dirty	Clean	Dirty	Clean
(Shillings per ton)								
Calif.—U. K. or Continent	17/–	18/6	21/–	21/6	21/–	21/6	21/–	21/6
Gulf—U. K. or Continent	14/3	14/6	14/3	14/3	14/3	14/3	14/–	14/6
(Cents per barrel)								
Calif.—North Atlantic	65	65	65	65	65	65	65	65
Gulf—North Atlantic	18	18	20	20	20	20	20	20
Venezuela—North Atlantic	20	—	20	—	20	—	20	—
Tampico—North Atlantic	22	—	22	—	22	—	22	—

World Petroleum Abstracts

Summaries of the Most Important Articles as Published in the Oil Press of the World Dealing With Technical and Economic Aspects of the Industry. *Edited by Dr. O. W. Willcox*

Petroleum Geology

THE RODESSA FIELD.—John S. Ivy, before A.P.I. Div. of Production, Shreveport, April, 1936 (Oil Weekly, 1936, p. 21).

The Rodessa field was discovered August 3, 1930, and the discovery oil well completed July 7, 1935. April 1, 1936, there were 120 oil wells and 20 gas wells in the field. As of the same date, 4,689,000 bbl. of 43 gravity paraffin base oil had been produced. About 6,500 acres are proved for oil.

The accumulation of oil and gas occurs on the upthrown side of the main Rodessa fault in horizons underlying the Massive Anhydrite member of the Glen Rose formation at a depth of about 6,000 ft. The structure is typically fault-line in type.

Wells are drilled with heavy-duty rigs and completed in about 45 days. Principal drilling difficulties encountered are sticking and twisting-off of drill pipe, "wash-outs," and the sticking of casing and liners.

The principal production problem is that of excessive gas-oil ratios, due to the failure to land and cement the production string below the gas-oil contact which occurs at a subsea depth of about −5,725 ft.

This paper gives a good summary of the geology of the field.

VERTICAL DISTRIBUTION OF BACTERIA IN MARINE SEDIMENTS.—Claude E. Zobell and D. Quentin Anderson, in BULL. AM. ASSOC. PETROLEUM GEOLOGISTS, vol. 20 (1936), No. 3, pp. 258–269.

Bacteria are believed to be the chief agents in the decomposition and transformation of organic matter in marine sediments, and the alteration of organic constituents of these sediments at time of deposition is an influential factor in the origin of petroleum. The presence of bacteria in these sediments has therefore been deemed worth an investigation.

Off the coast of Southern California bacteria are more abundant in marine sediments than in the overlying water, there being thousands to millions per gram of sediment and only a few hundred or less per milliliter of water. The distribution of bacteria in the sediment is more or less independent of the depth of the overlying water, the temperature of the ocean floor, and the distance from mainland. The bacterial population seems to be influenced more greatly by the organic content of the sediments than by other factors. Vertical sections from cores 40 to 75 cm. in length show that the number of bacteria in the sediments decreases greatly with depth in the upper 5 cm. of the core and more slowly beyond. In the surface slime, aerobes are 5 to 100 times more plentiful than anaerobes, but at depths exceeding 15 centimeters about as many anaerobes as aerobes are present. Both anaerobes and aerobes have been demonstrated at all depths analyzed. The oxidation-reduction potential increases with core depth, although the oxygen-absorbing capacity decreases with depth. Both properties are ascribed primarily to bacterial activity. Bacteria recovered from marine sediments exhibit many biochemical processes.

ROCK TEMPERATURES AND DEPTHS TO NORMAL BOILING POINT OF WATER IN THE UNITED STATES.—H. Cecil Spicer, in BULL. AM. ASSOC. PETROLEUM GEOLOGISTS, vol. 20 (1936), No. 2, pp. 270–279.

A table is presented that shows the highest and lowest extrapolated temperatures at two given depths—5,000 and 10,000 ft.—for 162 localities in 24 states of the United States. Computed maximum and minimum depths to 212 deg. F. are also given for each locality.

The conclusion of Van Orstand that the depths to boiling point temperature are frequently less than 10,000 ft. is borne out by this paper. At approximately a third of the localities considered the boiling point is reached at a computed depth of 7,000 ft. or less, and in the other two-thirds of the localities the depth to this temperature is 10,000 ft. or less. Extrapolation of the curves show that a temperature of 689 deg. F. should be reached at between 30,000 and 40,000 ft.

ORIGINS OF PETROLEUMS: CHEMICAL AND GEOCHEMICAL ASPECTS.—Benjamin I. Brooks, in BULL. AM. ASSOC. PETROLEUM GEOLOGISTS, vol. 20 (1936), No. 2, pp. 280–300.

The survival of organic material in oil shales of great geological antiquity is evidence against the assumption that petroleums have been formed by the heat decomposition of organic material. Another evidence of the low-temperature history of oil shale is the discovery of Treibs that many shales, asphalts, and asphaltic petroleums contain chlorophyll porphyrins. The fact that many petroleums contain complex labile substances easily decomposed by heat, may indicate that cellulose, peats, and coals are progressively carbonized under pressure and during geologic time at temperatures much lower than has heretofore been assumed. The carbon-ratio theory has only a negative value in relation to petroleum occurrence.

Some bottom-hole temperatures in producing fields do not exceed 100 deg. F., and are in strata only slightly arched or disturbed.

The conclusion seems warranted that organic materials as stable as the paraffins and some waxes, once formed and sealed in the sedimentary rocks, normally undergo no further changes due to the influence of heat.

The principal types of organic substances which are to be considered as the main source material for petroleum include cellulose, starches, sugars, proteins, lignins, oleo-resins, waxes, and fatty oils. Fatty oils are to be regarded as the principal source material.

Putrefactive decomposition of organic matter is recognized as an initial step in the formation of petroleum. More experimental evidence is needed on the rôle of bacteria in the formation of petroleum. At present the depth at which bacterial action ceases is not known.

The low-temperature history of petroleum favors the view that the hardening of sedimentary rocks is due entirely to compaction and the deposition of cementing material from solution.

The chemical evidence agrees with the maximum temperature of petroleum formation, 140 deg. F., as suggested by McCoy and Keyte.

Geophysics

A NEW REFLECTION SYSTEM WITH CONTROLLED DIRECTIONAL SENSITIVITY.—F. Rieber, in GEOPHYSICS, vol. 1 (1936), No. 1, pp. 97–106.

In regions of flat lying beds the usual reflection method, including the use of directional reception by group geophones, produces satisfactory results since it is adapted to accentuate on the record waves arriving from the relatively flat structure. In more steeply folded regions, containing faulting, waves are returned to the receiving apparatus from a wide variety of non-vertical directions. These waves must be separated and identified if a correct picture of the structure is to be made. The usual type of seismograph with visual record is not able to do this. The new system described by the author employs the additional factor of controlled directional sensitivity which makes it possible to break down the complex combination of waves arriving from different directions in space, and to separately identify such waves, thereby permitting a more accurate reconstruction of the geological conditions.

The controlled directional sensitivity is achieved by making the records in two successive stages instead of recording directly the output from the geophones. The original record is made on film as a sound track, very similar in nature to those used in talking pictures. These are intended solely to make possible the second step, that of directional analysis. These sound tracks are then fed through an analyzer in which, by optical and electrical adjustments, the complex group of recorded waves is broken down and a large proportion of the individual waves may be separately identified.

Among the results achieved have been the identification of steep folds and of faults, under conditions where any of the earlier forms of equipment with fixed directional characteristics would have produced records of such complexity as to defy visual analysis. An interesting aspect of the new method is its ability to delineate a consistent series of strata of rela-

tively uniform altitude which return definite and strong reflections, and at the same time to identify with certainty the relatively small and sporadic waves returned from an entirely different feature, such as a fault plane.

Electrical Mapping of Oil Structures.—J. J. Jakosky and C. H. Wilson, in MINING AND METALLURGY, vol. 17 (1936), No. 353, pp. 231–237.

This paper describes an electrical resistivity method for mapping subsurface structures which depends on the conductivity of rocks when current is passed into the earth at two different points. It is considered to be more economical than seismic work for investigating depths up to 3,500 or 4,000 ft. from the surface. In areas where shallow beds are in general conformity with the deeper oil-producing horizons the method is of particular advantage. In areas where the shallow beds are structurally indicative of the deeper beds the method may be of special advantage for general reconnaissance, with later detailed work by the gravitational or seismic methods.

This method differs from prior electrical methods in maintaining an accuracy of measurement and interpretation consistent with the small changes in value introduced by the deeper subsurface stratigraphic changes, largely because of the following factors: (1) minimizing the variation in apparent resistivity with time of current flow, by means of a constant time of measurement; (2) eliminating the variation in apparent resistivity with density of current flow by systematically increasing the total current flowing in the energizing circuit as the volume of earth increases with greater depths of penetration; (3) development of a graphic method of interpretation, based primarily on the depth-resistivity logs obtained from the surface measurements; and (4) multi-directional measurements, which allow evaluation of topographic and near-surface effects.

Micromagnetic Surveys.—W. P. Jenny, in OIL WEEKLY, vol. 81 (1936), No. 6, pp. 23–31.

The magnetic method of investigating buried structures has recently been revolutionized in a three-fold way. The magnetometer has been greatly improved. The field technique has now been improved to such an extent that it is possible to measure the magnetic field with an accuracy of plus or minus two gammas as compared with an accuracy of from plus or minus 10 to plus or minus 25 gammas. The basic assumptions for the interpretation of magnetic anomalies have been changed completely. In former years it was thought that all magnetic anomalies were caused by the basement or shallow igneous rocks. Today it is known that there exists sufficient difference in the magnetic susceptibility within the sedimentary columns to produce noticeable anomalies above structures of commercial interest. The author presents facts that seem to offer conclusive proof that Gulf Coastal structures can actually be outlined and quantitatively interpreted by the micromagnetic method. From comparative experience with other geophysical methods the author is convinced that, on the average, a properly conducted and interpreted micromagnetic survey has as much resolving power as other geophysical surveys, and in as much as the location of faults is concerned the resolving power of a micromagnetic survey is at present surpassed only by clear-cut surface evidence or by the drill.

The Shoestring Oil Sands.—John F. Patton, in MINES MAGAZINE, vol. 25 (1935), No. 12, pp. 17–23 (G.A., No. 84, April 1936).

The geologic occurrence and the possibilities of tracing the so-called "shoestring sands" with geophysical methods are discussed under the headings: (1) Geographical distribution; (2) Origin of the "shoestring" sands, and characteristics for determining the type of deposit; (3) Methods of tracing the shoestring trends; (4) Composition and character of the sand; (5) Relation of structure to production; (6) Production of the shoestring pools and possibilities of extending them; (7) Application of geophysical methods in tracing shoestring sands.

The author concludes: "In the application of geophysical methods, as well as in geologic work, it is essential to determine the likely trend from considerations of the type of deposit and make all interpretations in the light of this information. At the present, I do not think we have any way to measure physical effects of the shoestring sands which would be of sufficient magnitude to locate the sand if its presence was not already expected. However, if the sand is known to exist and we can establish a series of small anomalies in the direction that it would be expected to follow, then our results should warrant further investigation with the drill."

Oil Well Operation

Production Methods in the Oklahoma City Field.—Fred A. Lichtenheld, in OIL WEEKLY, vol. 80 (1936), No. 11, pp. 42–43; 52.

The Oklahoma City field is a proving ground of production practices for wells of 6,500 feet in depth. Six different methods are employed successfully in the production of crude oil within that area. Broadly stated, these may be listed as (1) natural flow, (2) gaslift and various gaslift devices, (3) electrical submerged centrifugal pump, (4) pneumatic pumping cylinder, (5) walking beam, and (6) hydraulic submerged pump. A possible seventh may be called a reciprocating hydraulic head type. With the exception of one, the general principles involved in each type have been used for years in other industries and have been adapted for oil field practices.

The new method of operation referred to is based upon hydraulic principles. Fluid is pumped down a string of 1¼-inch tubing, causing a plunger to reciprocate. This plunger is directly connected to a second plunger, the suction of which opens to the well. Both cylinders discharge into the 2½-inch tubing leading to the well head. The 1¼-inch, or pressure tubing, is run inside the 2½-inch tubing and is packed off near the bottom of the hole with a ground joint fit. More fluid comes from the well than is pumped down the power tubing and represents the well's production. Filtered oil is used for power fluid, which is preheated to combat paraffin conditions, as well as to lower the fluid's viscosity. The surface power pump, filters, heater, gas separator and clock control switches are designed in a compact unit. Electric motors are used to drive the power pump and filter.

These hydraulic pumps are built in four sizes. The two-inch outer tubing has a capacity of 100 bbl. per day; the 2½-inch, 200 bbl. per day; the three-inch, 400 bbl. per day; and the four-inch tubing, 800 bbl. Each size also requires a different power pump and motor. The power pumps are driven by a 7½ or 15-horsepower electric motor, and their selection depends upon the size of tubing used and probable well production.

Natural Gas

A Variable Vapor Volume Barometric Type of Vapor Pressure Apparatus.—Everett M. Barber and A. V. Ritchie, before Am. Chem. Soc., Kansas City, April (1936).

This paper describes the design and operation of a barometric type of vapor pressure apparatus, which is so constructed that the vapor pressure of gasolines to naphthas can be measured from zero to any desired intermediate percent evaporated.

While adaptable to routine tests, the apparatus is more accurate and reproducible than the conventional Reid vapor pressure test, and also gives more detailed information. In measurements of the vapor pressures of pure compounds, the I.C.T. values were checked to within 2 mm., and repeated tests on a single gasoline sample showed a probable (50 percent) error of 1 mm. of mercury.

Application of the results to the measurement of evaporation losses and to the measurement of the vapor locking characteristics of gasoline is briefly discussed.

Back-Pressure Data on Natural-Gas Wells and Their Application to Production Practices.—E. L. Rawlins and M. A. Schellhardt, in U. S. BUREAU OF MINES, MONOGRAPH 7 (1936); 210 pages.

The capacity of a natural-gas well to produce gas usually is determined by measuring the open-flow delivery of the well and the shut-in pressure at the wellhead. The open-flow delivery is measured with a Pitot tube while the well is flowing "wide open," and there necessarily is a loss of a large volume of gas to the atmosphere, especially for those wells where the rate of stabilization of the impact pressure as indicated by the Pitot tube is slow and a long "blowing" period is required to obtain equilibrium conditions. Furthermore, subjecting gas wells to extreme conditions of flow, such as occur when open-flow tests are made, causes sand and line formations in the well to cave, aggravates water "coning," and increases the possibility of trapping gas permanently by water in the underground reservoir. Also, under such conditions of flow as obtain when wells are gauged by the open-flow method, abrasive materials often are carried with the gas from the well at high velocity, damaging well equipment and creating an operating hazard.

Pressure and flow data obtained on gas wells under open-flow conditions only do not indicate the delivery capacity of the wells under normal operating conditions, are not a reliable basis for controlling production, and are not

adequate for studying the gas-production problems created by the presence of liquids in the sand, sand caving, shooting, clogging of sand face, and unsuccessful completion jobs.

Analyses of data obtained while the producing characteristics of 582 gas wells in the principal gas-producing areas of the United States were being studied have shown that there is a consistent relationship between the rate of delivery of gas and corresponding pressure differentials between the formation pressure and the pressure at the sand face in the well bore throughout the producing range of a gas well. When rates of delivery of gas are plotted on logarithmic paper against $P_f^2-P_s^2$—the respective differences of the squares of the formation pressure P_f, and the pressure at the sand face P_s—the relationship is represented by a straight line which may be expressed mathematically by the formula

$$Q=C(P_f^2-P_s^2)^n,$$

where Q = rate of flow, cubic feet per 24 hours;
C = coefficient;
P_f = shut-in formation pressure, pounds per square inch absolute;
P_s = back pressure at the face of the sand in the well bore, pounds per square inch absolute;
n = exponent, corresponding to the slope of the straight-line relationship between Q and $P_f^2-P_s^2$ plotted on logarithmic paper.

Rates of delivery of gas corresponding to various back pressures can be ascertained from the plotted relationship established from a limited range of pressure-flow data obtained under relatively high operating pressures and the straight line can be extended to the pressure factor $P_f^2-P_s^2$ that would exist under open-flow conditions and the open-flow delivery of gas read directly from the plotted relationship.

This work is filled with details that should be extremely helpful to every gas well engineer.

Corrosion Mitigation on the West Coast.—Lee Holtz, in NATIONAL GAS WEEKLY, vol. 77 (1936), No. 16, pp. 403–407; 409.

This paper is a summary of the experience and practices of the Southern California Gas Co. which has a network of 5,500 miles of mains covering a territory 350 miles from north to south, and 70 miles from east to west; embracing every variety of climate from hot deserts and high, cold mountains to humid lowlands and tidal marshes; a layout that has required the analysis and classification and mapping of more than 11,000 soils. The records of corrosion accumulated over a period of years are very extensive; these records have been subjected to intensive study, and have inspired extensive research on the causes and prevention of corrosion. The use of copper pipe is now standard practice for certain kinds of soils and operating conditions; remarkable success has been obtained in heavy alkaline soils, where copper appears to have an indefinite life. It is true that copper will deteriorate rapidly in the presence of moisture and sulphur, but it is practicable to obviate this condition. The greatest source of internal corrosion of all gas pipe is moisture content, but dehydrating plants (using calcium chloride) have been built for reducing the moisture content to a negligible figure.

The experience of this company with protective coatings has been wide. The specifications for the most improved coating now in use is as follows:

1. One coat primer on sandblasted pipe.
2. One coat asphalt, 175 deg. F. melting point, 20 normal penetration, 4.5 ductility.
3. Two wraps cellulose base paper.
4. One coat asphalt, same as No. 2, above.
5. One wrap Kraft paper.

This coating is distinguished by the layer of paper over pipe that has first been primed with a layer of high grade blown asphalt approximately 3/32 inch thick.

The difficulties encountered in building a homogeneous coating which will resist both water and soil stress are overcome by applying an inner layer of cellulose material designed to keep out water and an application of a shield coating of the same material is added to alleviate soil stress. In this manner a "slip joint" is created whereby the outer layer takes up all the effect of soil stress without distortion to the inner layers.

The effectiveness of this principle has been proved by periodic inspections made on installations in many types of soil over a period of four years. In many cases the outer layer of asphalt has become brittle and distorted by soil action, and moisture has been found under this layer, but in all cases the inner layer has been found to be free of any defects and the pipe has remained in perfect condition.

The hope is expressed that some day the steel manufacturers will produce an inexpensive metal of such a character that costly protective measures will be superfluous.

First Butane-Electric Locomotive.—Announcement of General Electric Co., April, 1936.

A year of successful operation has proven the practicability of the world's first butane-electric locomotive. Purchased one year ago by the Acme Steel Company, Chicago, Illinois, from the Plymouth Locomotive Works, Plymouth, Ohio, for use in the steel company's yards in Riverdale, Illinois, the locomotive has met all service expectations. It is conservatively estimated that this 65-ton locomotive can do 50 percent more work in a given period than either of the two steam locomotives which it replaced. Powered with two Climax engines, modified for butane fuel consumption, with electric traction equipment by the General Electric Co., the advantages of smooth and rapid acceleration and low maintenance have been fully realized. Butane was selected as the fuel since it could be purchased at almost the same price as Diesel oil and could be used in equipment which was approximately 30 percent lower in initial cost.

The design of the locomotive is such that maximum visibility is obtained by the single operator required. Over-all length, exclusive of the coupler knuckles, is 40 ft., width is 10 ft., and the height over the cab is 14 ft. The two Climax engines are of the 8-cylinder, 6 by 8 inch heavy-duty type and are designed to produce 253 h.p. at 1,200 r.p.m.

The adaptations of the Climax engines for butane consumption include a change in compression ratio and modified carburetion features. Butane is loaded into the two 125 gallon fuel tanks as a liquid, but at approximately 10 deg. F. and above the vapor pressure of the liquid forces the fuel, as a gas, into the mixing valves of the engines. Beside low cost, butane has the advantages of forming no carbon and producing no crank-case dilution.

The locomotive is reported to consume an average of 10.75 gallons of fuel and 0.1 gallon of lubricating oil per hour of heavy-duty switching service.

Pipelines

Steel Pipe Coupling Protection on Natural Gas Lines.—Anon., in GAS AGE-RECORD, vol. 77 (1936), No. 11, pp. 241–256.

A "mummification" method of protecting steel pipe couplings on gas lines (generally known as Dresser couplings) has come into use in the southwest. The process consists of enclosing the Dresser coupling in a wooden shield or barrel, made of flat wooden slats, which is wrapped around the pipe at the joint, leaving a hollow space. The cracks between the slats are chinked with clay, and hot pure coal tar pitch is poured in through an opening left for that purpose. The tar thus encloses all the coupling parts—ring, bolts, and followers and provides a complete and permanent protection from corrosion. The pipe itself is covered with a hot coat of enamel and wrapped with an asbestos felt wrapping as a protection against corrosion by the soil.

Wind-Powered Generators for Cathodic Protection of Pipe Lines.—F. H. Love, in PETROL. ENG., vol. 7 (1936), No. 5, pp. 31–33.

Recent design and construction of wind-powered generator units for use in the cathodic protection of pipelines have resulted in a great increase in their efficiency and have greatly widened the field of application. The chief developments in this line are: A perfected automatic current regulator, and certain improvements that enable the unit to commence operating on a lower wind velocity than formerly. The rated output is maintained regardless of external resistance and the wind velocity required for starting is now 3 to 3½ miles an hour rather than eight miles, as formerly. This assures that the unit will be operating at least 50 percent of the time, as compared with 70 percent of down time when eight miles was the minimum wind velocity for starting. Results obtained from such installations by the Texas Pipe Line Co. and the United Gas Public Service Co. have been exceptionally satisfactory. The newer units are of 40 amperes capacity and each unit will afford protection to about 1½ miles of pipeline.

Petroleum Refining

Decolorizing Powers of Various Materials, Especially Filter Clays.—E. Erdheim, in PETROLEUM, vol. 32 (1936), No. 11, pp. 5–8.

This investigation was prompted by the fact that the author could not find in existing literature any information regarding the connection between the decolorizing power of a filtering material and the intensity of the color of a mineral oil. His experimental study was extended to 21 commercial materials and included American and European carbons and clays.

The investigation disclosed that the decolorizing ability of most filtering materials varies with the depth of color of the oil, the effect generally being smaller the darker the color of the oil. However, this "diminishing effect" is a characteristic of each decolorant. In only one case did the decolorant have the same rela-

tive decolorizing power for all depths of color; this was an active carbon made from birch wood; in this respect the carbon decolorizers generally show slighter variations than the activated or unactivated clays.

Manufacture of Paraffin Wax from Petroleum.—Ralph H. Espach, published as BULLETIN 388 OF THE U. S. BUREAU OF MINES, Washington (1935), 113 pages.

This publication is a fairly complete survey of the manufacture of paraffin wax in the United States. The information given by the author was accumulated in 1929 and 1930 when 30 wax manufacturing refineries located throughout the United States (excepting California and the Rocky Mountain region) were visited. These 30 refineries had an approximate total wax production of over 75 percent of the annual United States production at that time. The wax manufacturing process and the equipment employed are essentially the same at present as in the years named, but improvement has taken place in the fractionation of the crude oils. This has resulted in improved products and also in raising new difficulties, which are being met by resort to solvents.

All these old and new matters are discussed in detail, and those interested in the manufacture of paraffin wax will find here information which is perhaps more complete than is contained in any other current work. There are 37 illustrations, including reproductions of standard microphotographic plates that are used in control of the crystallization process, a method which was evolved primarily by members of the research department of the Tide Water Oil Co.

Refiners in Modernization Program.—F. L. Kallam and W. L. Rifenberick, in PETROLEUM WORLD (Calif.), vol. 33 (1936), No. 1, pp. 26–28.

This is a review of progress in the California oil refining industry in 1935. By reason of the curtailment program only about 56 percent of the total refining capacity is being utilized, and many of the plants now shut down will never be reopened, because they are obsolete. Nevertheless, there is a manifest tendency toward the construction of more efficient plants, especially among the smaller companies. A characteristic of the California refining industry is that most of the production is now turned out by large establishments, 80 percent of the refined products coming from plants with rated capacities of over 10,000 bbl. daily, while 45 percent of the production is handled by units with capacities of over 50,000 bbl.

Among contemporary items of progress the matter of polymerization has been holding the center of interest, although the raw stock available for polymerization is relatively limited in comparison with cracking stock, and part of this stock, i.e., the butylene and propylene, is being competed for by the chemical industry, which is using it for the manufacture of alcohol and other chemicals. But for certain purposes a certain amount of polymerized gasoline is indispensable to the refiner. It is an effective substitute for Q compound and ethyl in commercial gasolines to bring up the octane rating, although here it must compete with cracked gasoline which is made in a plant that costs less. However, in the special field of gasoline with very high octane ratings, as aviation gasolines, polymerized gasoline is apparently without a rival. It is said that 100 octane gasoline can be produced that will be worth 25 cents a gallon for army and navy purposes; the reason is that 20 percent more power can be obtained from a given engine with an increased compression ratio; however, it is not supposed that ordinary automobilists would pay such a price for gasoline.

Technical developments during the past year in connection with atmospheric units have been practically nil. Probably the stabilization of light flash straight-run gasoline is one of the few steps taken that will help the small refiner to improve his product from the standpoint of front end volatility by excluding all lighter hydrocarbons, such as iso-butane and propane. Even a major refiner is rectifying his flash gasoline.

Of the new processes put in use within the year some have been developed by the refiners themselves, but on the whole the California operators prefer the highly developed licensed cracking units, such as the Dubbs, Cross, Holmes-Manley, Clark, Sinclair and Tube-and-Tank. Consensus is that these units, despite the royalty requirements, are the most economical to operate.

Catalytic Desulphuring of Russian Gasoline at Normal Pressure.—I. N. Tietz et al, in NEFTJANOJE CHOSJAJSTWO, 1935, No. 2 (OEL UND KOHLE, vol. 12, p. 238).

Gasoline of high sulphur content (0.41–10.98 percent) from Russian shales can be satisfactorily desulphurized by a catalytic method. The catalyzer is prepared by precipitating a solution containing equal parts of nickel and aluminum nitrates with sodium hydrate; to the precipitate is added some extra aluminum oxide and the dried mixture is reduced with hydrogen at 350 deg. C. Experiment showed that the gasolines investigated could be reduced to a sulphur content of not more than 0.1 percent, which is considered satisfactory for commercial gasoline; some of the shale oil gasolines especially rich in sulphur required more than one passage over the catalyzer. Raising the temperature from 350 deg. to 400 deg. favored the desulphurizing process, but was attended by a considerable loss of gasoline, amounting in some cases to 19.4 percent. The catalyzer in time becomes poisoned, but is easily regenerated.

Refinery Accounting.—B. R. Johnstone, in CERTIFIED PUBLIC ACCOUNTANT, vol. 16 (1936), No. 2, pp. 84–86.

Year by year the oil industry is depending more and more on independent auditing firms to step in and audit their books and make inventories. The essential data are given by accurate gauging and daily records,consolidated in monthly yield sheets.

From the monthly yield sheet is obtained the information for working up the Cost of Production for the month. There are several methods in use at the present time: (1) Apportionment Sheet, by which the total yields are extended at the average wholesale selling price for the month, or preferably a six months' average, and the Manufacturing Cost, i.e., cost of crude run plus the cost of operation, prorated to the production based on the ratio of the Manufacturing Cost to the Total Wholesale Selling price of the total production, in which case a ratio of less than 100 will mean a crude equivalent cost for each product of less than the wholesale selling price and consequently a spread, and a ratio of more than 100 will mean a higher crude equivalent cost than the wholesale selling price for each product. (2) Considering the gasoline yield as the main product and charging that stock with the total Manufacturing Cost and crediting it with the wholesale selling price of all other products yielded, in which case the selling price and crude equivalent cost of these products are the same and the total spread is reflected in the gasoline production.

The advantages of the first method are that it gives a crude equivalent cost for each and every product yielded and does not consider any product as a main product. The disadvantages are that the total manufacturing cost is pro-rated to all products, although contained in such costs are costs which can be and should be definitely apportioned to a particular product or products. For instance, treating cost, ethylizing costs, re-running, reforming costs, etc., are costs which can be definitely allocated and consequently the same should be excluded from that portion of the manufacturing cost which is to be pro-rated.

As to the second method, these do not appear to be any advantages, as at the present time the gasoline production at a refinery is no longer the chief aim of the production department but only one of many main products desired.

The apportioning of refinery costs is a subject about which the accounting profession could well afford to give some serious thought, as the present methods in use do not reflect the accurate costs and the oil industry is ready for any suggestions which will tend to reflect more accurate costs for their production, providing the same are not too complicated.

Petroleum Chemistry

Determination of Gaseous Olefins or Hydrogen by Catalytic Hydrogenation.—Wallace A. McMillan, Howard A. Cole and A. V. Ritchie, in IND. ENG. CHEM., analytic. ed., vol. 8 (1936), No. 2, pp. 105–107.

Existing methods for the analysis of olefinic gases may properly be divided into two classes: those using sulfuric acid, and those using bromine, but both depending on the reagent to react selectively with the olefins, leaving untouched any paraffins or cyclics present. For accurate work this is an admitted impossibility, even when the gaseous mixtures are separated by low-temperature fractional distillation and the resulting fractions are analyzed separately. Corrections must still be applied, which are at best rather doubtful, since these so-called selective reagents possess, in common with all absorption media, the undesirable ability to take up varying amounts of substances other than the one they are being applied to absorb, and then to regenerate a portion of the dissolved constituents when used with another gas of different composition, when nearing saturation, or with changes in temperature. In addition, reagents for the determination of olefins are corrosive and volatile, necessitating unusual precautions and auxiliary reagents.

A new method for the quantitative determination of gaseous olefins by catalytic hydrogenation which has been developed and used

for the past three years, gives consistent reproducible results accurate to a few tenths of a percent in a time comparable with that of any liquid reagent method.

It requires only that a measured volume of hydrogen be mixed with a known quantity of olefin-containing gas and the mixture passed over a suitable catalyst at room temperature and substantially atmospheric pressure. The resulting contraction in volume is a direct measure of the amount of olefin present according to the reaction:

$$C_nH_{2n} + H_2 \longrightarrow C_nH_{2n+2}$$

The catalyst is made by saturating shredded long-fibered asbestos in pure nickel nitrate hexahydrate melted in its own water of crystallization, and igniting the mass until it turns partly black and partly greenish-yellow. The method is now being used in the laboratories of the Texas Company for the determination of total unsaturation and hydrogen, and in conjunction with low-temperature fractionation to give a complete analysis of refinery and cracked gases. In spite of rough usage and exposure to gases containing sulphur there have been no catalyst failures in three years.

The Effect of Sulfur Compounds upon Lead Response.—S. F. Birch and R. Stansfield, before Am. Chem. Soc., Kansas City, April (1936).

The relation of sulfur compounds in gasoline to lead response was investigated. In a 65 percent octane, 35 percent n-heptane blend, thiophene sulfur had the least effect with decreasing lead response in the following order: sulfide, mercaptan, disulfide, trisulfide, thioglycol sulfur. The effect of trisulfide is expected by analogy to peroxides, but the effect of disulfide is surprising in that it is not greater. Blends of hydrocarbons also were investigated. Cyclohexene displays unusual properties due to pre-ignition. Blends of heptane and olefin show poor lead response and considerable reduction due to sulfur compounds. This may explain the action of cracked gasoline. Work with Iranian and Venezuelan straight-run gasolines indicates a saving in lead by thorough desulfurization.

Oil Oxidation: The Reaction Which Is Unaffected by the Products.—Ralph W. Dornte and C. Vaughan Ferguson, before Am. Chem. Soc., Kansas City, April (1936).

The rate of oxygen absorption in a circulatory system has been applied to a study of lubricating oils whose oxidation is unaffected by the non-volatile oxidation products. All experimental results can be represented by a simple empirical rate law: The total oxygen absorbed is a linear function of the time at constant temperature. The rate of oxidation varies nearly linearly with the partial pressure of oxygen. The principal oxidation products are water and carbon dioxide; no carbon monoxide or peroxides are formed. It is probable that a chain mechanism is not involved in this oxidation. The net heat of activation for oils of this type varies between 19,000 and 43,000 cal.

The catalytic effect of copper, iron, tin, and lead has been studied by the oxygen absorption procedure. The catalytic effect of these metals depends upon the oxygen partial pressure and the ratio of metal to oil. For copper the rate of oxidation increases rapidly with the copper-oil ratio; for the other metals this ratio has only a slight effect. The net heat of activation for the catalyzed reaction has been determined for a fixed metal-oil ratio. These metals cause no significant change in the net activation heat, although the rate of oxidation is increased several fold. This is due to the rather large error inherent in the determination of the heat of activation. The method gives a sound empirical evaluation of catalytic effects on oil oxidation.

Polymer Gasoline.—Gustav Egloff, before Am. Chem. Soc., Kansas City, April (1936).

There are three polymerization processes in operation at the present time. Two of these are thermal and one catalytic. The so-called "unitary process" for the conversion of hydrocarbon gases operates at a temperature of 950 deg.—1,100 deg. F. and pressures of 1,000–3,000 lbs. per square inch. The "multiple coil" polymerization and cracking of hydrocarbon gases operates under a three-stage principle of 900 deg.–1,000 deg. F. and pressure of 600–800 lbs. followed by a gas pyrolysis operation to produce olefinic gases at 1,300 deg. F. and then a polymerization reaction at 1,150 deg.–1,300 deg. F. and pressure of 50–75 lbs., while the catalytic process polymerizes olefinic gases at temperatures of about 450 deg. F. and 250 lbs. pressure followed by catalytic dehydrogenation of paraffin gases at 950 deg. F. and atmospheric pressure, followed by catalytic polymerization.

Gasoline from Ethylene by Catalytic Polymerization.—V. N. Ipatieff and B. B. Corson, before Am. Chem. Soc., Kansas City, April (1936).

Gasoline of 82 octane number (C. F. R. motor method) has been produced by the polymerization of ethylene over a commercial "solid phosphoric acid" catalyst. The steam-distilled 400 deg. F. end point gasoline showed the following characteristics: color, deg. Saybolt, 30+; color stability, 26 (equivalent to two hours of noon June sunlight); gum (copper dish), mg./100 cc., 10; induction period, 100 minutes; induction period plus 0.025 percent of wood distillate inhibitor, 1,600 minutes.

Eight gallons of liquid polymer were produced per 1,000 cubic feet of ethylene, of which 60 percent distilled under 400 deg. F. The polymer was a mixture of paraffins, naphthenes, olefins, and aromatics. Two gaseous products were also obtained, isobutane and butane.

Oxidation of Naphthenes in Mixtures Containing Oxygen, Nitrogen and Sulphur.—N. I. Tschernoshenkoff and S. E. Krein, in Neftjanoje chosjajstvo, 1935, p. 59 (Oel und Kohle, vol. 12, p. 238).

In order to obtain further information as to what substances promote the oxidation of petroleum oils and what substances act as protectors against oxidation (inhibitors), the authors heated a purified vaseline oil in a bomb for three hours at 150 deg. C. under a pressure of 15 atmospheres in the presence of oxygen. To the oil was added a varying proportion of an oxygen compound, a nitrogen compound, or a sulphur compound.

As oxygen compounds they used phenols, alcohols, aldehydes, ketones, quinones, fatty acids and oxyfatty acids. Among these the phenols—especially the ortho compounds—showed the strongest protective action, the oxygen attacking them in preference to the mineral oil; the oxidation products of the phenols themselves have a protective action. The quinones come next in protective efficiency, but have to be present in larger quantity to produce the same effect. Aldehydes and fatty acids accelerate oxidation of the oil, whereas the oxyfatty acids tend to delay it. To the same group belong certain resins isolated from partly oxidized mineral oils. On the other hand all sulphur-containing resinous substances and resins originating from aromatics show good protective action against oxidation. Naphthenic products are indifferent when present in small amounts, but promote oxidation when present in larger concentrations.

Among the nitrogen compounds investigated (aniline, beta-naphthylamine, pyridine and quinoline) beta-naphthylamine showed the best protection against oxidation, aniline is effective only in large concentrations. In the presence of pyridine and quinoline an increased oxidation of the oil was observed, the role of these substances appearing to be purely catalytic.

Preliminary experiments with organic sulphur compounds indicate that the protective action of these substances is proportional to their sulphur content.

Petroleum Physics

Parallel Scale Rule for Vapor Pressure Data.—F. J. Smith and H. B. Sharp, before Am. Chem. Soc., Kansas City, April (1936).

A very practical method of representing vapor pressure data is proposed in this paper. This presentation is based upon the usual Cox chart and is given in the form of parallel scale charts. These charts have been cemented to a specially prepared glued stick the size of the usual 20 in. log-log duplex slide rule and provided with a movable indicator glass. Such a completed vapor pressure rule has been found to be much superior for the calculation of engineering problems to the usual coordinate charts.

The Density of Hydrocarbon Gases and Vapors at High Temperature and Pressure.—W. B. Kay, before Am. Chem. Soc., Kansas City, April (1936).

The P-V-T relations of eleven typical petroleum hydrocarbon mixtures in the gaseous state have been determined experimentally over a wide range in temperature and pressure extending from the saturated condition below to the highly superheated condition above the critical region. The P-V-T data on the mixtures are expressed as deviations from the perfect gas law and are correlated in this form by means of the theorem of corresponding states using a particular temperature and pressure for each mixture, termed the pseudo-critical temperature and pressure for calculating the corresponding reduced quantities. It is shown in this way that the P-V-T relations of complex hydrocarbon mixtures can be calculated from the P-V-T relations of a pure hydrocarbon.

Methods and charts for estimating the pseudo-critical temperature and pressure of a petroleum mixture are given which make it possible to calculate its P-V-T data over a wide range of temperature and pressure.

Asphalt and Tar

AGING OF ROAD TARS AS A FUNCTION OF THEIR CARBON CONTENT.—A. Leaute and T. Vierfond, in COMPTES RENDUS ACAD. SCI. FRANCE, vol. 202 (1936), No. 5, pp. 416–419.

Laboratory experiments showed that the addition of finely powdered coal to a tar had the effect of diminishing the loss of volatile constituents and thus tended to retard aging of the tar. An attempt was made to ascertain how this would apply in actual road practice. It is concluded that the tarred layer constituting the finish coat of a road is subject to three categories of change in use: loss of weight by breaking and wearing, loss of weight of binder by evaporation or weathering, and an increase of the insoluble constituents of the binder at the expense of the portion soluble in carbon disulphide. During the first nine months of the test the loss of weight of the gravel exceeded the loss of weight of the binder, that is, in the gravel-tar surface the loss of tar constituents was greater than the loss of filler; whereas when the surface coat was made of the tar-coal mixture the reverse was the case.

ANALYSIS OF PRIMARY TARS.—G. Stadnikoff and N. Karakasch, in BRENNSTOFF-CHEMIE, vol. 26 (1936), No. 5, pp. 86–87.

The analytical methods used in the analysis of mineral oils usually fail to give information regarding the composition of primary tars, as in the latter case it is necessary to take account of oxidized compounds in the tar. These compounds may be quantitatively extracted by washing the tar with a saturated solution of ferric chloride in concentrated hydrochloric acid. A saturated solution of aluminium chloride or of tin tetrachloride will remove only the ketonic and alcoholic compounds. Although these solvents remove the oxygen compounds, they do not appear to affect the thiophenes.

MEASURING THE SUSCEPTIBILITY OF ASPHALTS TO TEMPERATURE CHANGES.—A. Holmes, J. O. Collins and W. C. Child, in IND. ENG. CHEM., analyt. ed., vol. 8 (1936), No. 2, pp. 100–104.

Prior to the introduction of modern distillation methods into the petroleum industry, the sources of petroleum asphalts were comparatively few. Subsequently, however, the increased use of vacuum pipe stills, as well as other improvements in refining methods, opened a considerably broader field, resulting in the production of asphalts from sources which previously could not be processed for that purpose in existing equipment without some decomposition. Modern methods have also made possible the manufacture of a larger number of asphalt grades than were formerly produced.

Asphalts, in general, are classified in several groups according to their use as binders and paving asphalts for the construction of roads, saturants and roofing asphalts for the roofing trade, as well as innumerable specialty products for many other uses. Each classification is subdivided into numerous grades depending upon their consistency, which is usually designated by one or more of the standardized tests.

No single factor has thus far been evolved which will adequately express the temperature susceptibility of an asphalt over the wide range of temperatures encountered in the commercial application of asphalts.

Present methods are not entirely suitable, because they are too limited in the range of consistencies over which they can be determined or require the use of apparatus and testing methods not commonly used or recognized as standards.

A combination of factors or indexes is suggested by which a definite measure of the temperature susceptibility characteristics of a wide range of asphalts can be determined. The softening point-penetration index indicates this characteristic over a narrow range of normal atmospheric temperatures, the ratio of penetration at 25 deg. C. to penetration at 0 deg. C. at subnormal, and the fluidity index at elevated temperatures (135 deg. C.).

These methods are equally applicable to straight reduced and oxidized asphalts and are easily determined by means of tests which are in common use.

NEW METHOD FOR DETERMINING TAR IN BITUMEN-TAR MIXTURES.—P. Kaunert and E. Florian, in OEL UND KOHLE, vol. 12 (1936), No. 11, pp. 230–235.

A re-examination of current methods for determining the amount of coal tar in bitumen-tar mixtures used as a protective coating for large pipes having shown the unsuitability of these methods, the authors have devised a new one. Their method consists of extracting a sample of the mixture with chloroform, washing the chloroform extract with caustic soda, drying with calcium chloride, and evaporating off the chloroform. A weighed quantity of the dried extract is then sulphonated with concentrated sulphuric acid, and an aliquot part of the solution of the sulphonate is examined in a Pulfrich stage photometer which measures the "degree of blackness", which in turn is a measure of the tar content.

BINDING POWER IN THEORY AND PRACTICE.—W. Riedel, in ASPHALT UND TEER, vol. 36 (1936), Nos. 8 and 9.

The question of the strength of adhesion between crushed stone and the binding material used in road construction has been and still is the subject of debate. There is not even agreement as to what method should be used to measure adhesion. It is not sufficient to join two pieces of stone together with a road tar and then measure the force required to separate the stones, because the strength with which the tar adheres to the stones is greater than the tensile strength of the tar itself. The real test of the adhesive power of a road binder is the question of whether the bond between stone and binder can be loosened by the action of water under the conditions that prevail in a paved road. A laboratory test that will show this relation has been developed at the Institute for Road Building (Dresden). This test is carried out as follows: The stone is crushed to an average size of 0.2 to 0.6 millimeter and mixed with the binder. After the mixture has set it is placed in a boiling solution of soda, the concentration of which is increased to a point where it is observed that the binder separates from the stone. The strength of the solution in which the separation takes place is an approximate measure of the adhesiveness of the binder. The test is rather a rough one, but it is sufficiently accurate to differentiate between poor, fair and good adhesiveness.

Objection has been made to this test on the ground that quartzites, granites, etc. which are very resistant to wear, show up badly by this test, whereas traps and softer rocks show up well. But the fact is that the hardest rocks of little adhesiveness are actually inferior materials as fillers for road purposes in spite of their resistance to wear.

ANALYSIS OF CRUDE TAR.—B. G. Simek and J. Kremar, in MITT. KOHLENFORSCH-INST. (Prague), vol. 2 (1935), pp. 92–100.

A new method for the proximate analysis of tar is described, requiring only a small sample (5 grams). The asphalt content and insoluble materials are determined as follows: 5 grams of the tar is dissolved in 80 cc. of benzol and the solution is poured into 500 cc. of gasoline. The precipitate is filtered off, washed, dried and weighed, treated with hot acetone and again dried and weighed. The dry residue is the "insoluble." The difference between the first and second weighings gives the "asphaltic substance." Some carbon tetrachloride is added to the acetone solution of the asphaltic substance and the mixture is distilled until a boiling point of 77 deg. C. is reached. The precipitate is filtered off and weighed; it is recorded as "carbene insoluble in carbon tetrachloride." The acid oils in the benzol-gasoline solution are polymerized with a mineral acid, the precipitated polymerized oils are filtered off and the filtrate is washed with caustic soda solution. The alkaline solution contains the sodium phenolates, from which the phenols are isolated by acidification.

The remaining neutral oils are separated by distillation from the benzol-gasoline solvent, and their paraffine content is determined by the Simek method.

Petroleum Uses

LABORATORY SERVICE TESTING OF AUTOMOTIVE LUBRICATING GREASES.—E. N. Klemgard, in IND. ENG. CHEM., analyt. ed., vol. 8 (1936), No. 2, pp. 83–92.

The annual production of lubricating grease in the United States is nearly 300,000,000 lbs. and about half of this is consumed in automotive units.

The importance and necessity of developing service tests of value in formulating improved automotive greases are emphasized in view of the grease industry's desire to meet more adequately the demands of modern cars, high-speed driving, and the consequent more severe lubrication conditions. Laboratory service tests have been devised which permit comparisons of service properties to be ascertained more quickly, economically, and precisely than in more laborious road tests. Road tests are, however, considered necessary for final evaluation of service properties.

Mechanical apparatus has been developed

for testing the ability of pressure-gun greases to "stay in place", for testing universal joint grease, wheel bearing greases, steering gear grease and water pump grease, besides the usual chemical tests for freedom from injurious properties.

COMBUSTION QUALITIES OF DIESEL FUELS.—G. D. Boerlage and J. J. Broeze, before Am. Chem. Soc., Kansas City, April (1936).

Combustion, not ignition, is considered. Thorough knowledge of the process is required for evaluating fuels. Combustion can be sufficiently rapid for the highest speed. Uneven distribution and liquid fuel on walls cause after-burning (smoke, carbonization, lack of power). Data provided show how fuel properties affect mixing process and thereby efficiency of combustion. Volatility, ignition quality, and viscosity should be considered as the most important fuel properties. Lower ignition quality and lower volatility often allow of highest efficiency. Different chemical reactions in the engine are related to various products of incomplete combustion. Physical and chemical volatility are not covered by one test.

FACTORS WHICH INFLUENCE THE SELECTION OF METALLIC SOAPS FOR THICKENING MINERAL OILS.—C. J. Boner, before Am. Chem. Soc., Kansas City, April (1936).

Eighteen metals were combined with two fatty acids of different titer to form metallic soaps. Soaps from these combinations were heated with two mineral oils and cooled to find if a thickened oil or grease resulted. Soaps from nine of the metals gave greases worthy of consideration.

Of the metals which were effective all except one, aluminum, were either divalent or gave divalent combinations.

Soaps of the metals having the lowest atomic weights gave greases of best transparency.

In general the more basic metals gave soaps which produced the softest greases. Water as an emulsifier was not required except in the case of calcium and strontium soaps. The consistency was heaviest and the dropping point highest in soaps made from the highest titer fatty acid.

Behavior of the metallic soaps in both naphthenic and paraffin oils with a Saybolt viscosity of 100 at 100 deg. F. was similar.

Petroleum Economics

COORDINATION OF TRANSPORT.—Oskar Tokayer, in PETROLEUM PRESS SERVICE, vol. 3 (1936), No. 11, pp. 81–82.

According to a report by the U. S. Dept. of Commerce, a world-wide movement designed to effect national coordination of land, air, and water transportation is under way. It began on a broad scale about three years ago, but so rapidly has it progressed today that coordination is either being tested or approached in virtually every country of importance that has railway lines.

But it seems that coordination is largely a euphemism for a process of hobbling the automotive vehicle in favor of the railways. A survey of the legislation passed in different European countries during the past few years cannot fail to create the impression that, for the most part, it has been directed primarily to limiting the competitive power of road transport vis-à-vis the railways, rather than to securing the best possible transport system. These measures include (*a*) Special taxation of the type of road vehicle which competes with the railways; (*b*) Licensing systems which restrict freedom of entry into the road transport industry; (*c*) Restriction of the radius of operation of road services; (*d*) Control of minimum rates charged by road services; (*e*) Liberation of the railways from regulations which limit their ability to fix competitive charges.

The right to institute road transport services for either passenger or goods transport is now subject to the grant of an authorization of some kind in Great Britain, France, Germany (except goods transport under 50 km.), Italy, Spain, Denmark, Norway and Sweden, Poland, Czechoslovakia, Austria, Hungary, Bulgaria and Yugo-Slavia. Licenses for passenger services only are required in Holland, Belgium and Switzerland. In Belgium a law providing for the restriction of goods transport was passed in 1932 and detailed regulations for its enforcement are in preparation.

During the years 1930–1934, the British Government pursued a policy which was chiefly inspired by the desire to check rail and road competition, first in the passenger sphere and, secondly, in that of goods traffic. Under the Road Traffic Act, 1930, road passenger transport is effectively shackled, entry of newcomers into the industry is made difficult, and both services and rates are subject to official control. The prospects of future expansion are indeed limited to a point where no possible injury can be done to railway passenger traffic. Since the coming into operation of the Road Traffic Act, 1933, the road haulage industry has also been subject to legal restrictions which make its extension extremely difficult, while a heavy increase in taxation has greatly increased the cost of operating large goods vehicles.

In France, the deplorable financial position of the national railway systems has been brought about largely by heavy taxation and political interference. Anxious to improve the competitive power of the railways, the Government promulgated a decree in April, 1934, which prohibited forthwith the creation of any new public transport services either of goods or passengers and set up a Committee of Co-ordination charged with the task of negotiating agreements regulating the future relations between road and rail traffic in the various regions of France.

In Germany, where goods transport has been free from legal restriction since the commencement of the present régime, a law which comes into operation on April 1st, 1936, makes the transport of goods for third parties over distances exceeding 50 km. subject to the grant of a license by the Chamber of Commerce. In addition, rates charged by such services are made subject to the agreement of the Reichsbahn and approval by the Minister of Transport.

PETROLEUM AND THE FRENCH NATIONAL DEFENSE.—Louis Pineau, in COURRIER DES PETROLES, vol. 17 (1936), No. 702, pp. 1–2.

In this article the Director of the French National Office for Combustible Liquids outlines the problem of petroleum from the standpoint of the national defense. The dominant consideration is adequacy of supply, and for the creation of this supply the government will employ all available means. No source of motor fuel will be neglected, but the error of depending on questionable sources will not be committed. The distillation of oil shales will require such an investment of capital and labor, and will require such arrangements for protection that this source is ruled out from the military point of view. The obtainment of motor fuel from sugar beets, or from the hydrogenation of coal, cannot produce the volume likely to be suddenly required in the event of hostilities. The main reliance must, therefore, be placed on the creation of great petroleum reserves, and on the maintenance of naval power, supplemented by treaties or alliances with friendly nations, to guarantee the safety of oil imports.

FUTURE U. S. DEMAND FOR PETROLEUM.—Stuart St. Clair, in MINING AND METALLURGY, vol. 17 (1936), No. 353, pp. 246–249.

The author takes into consideration the following factors that will cause a decrease in the use of petroleum and its products.

(1) Reaching of saturation point in number of automobiles. This cannot obtain as long as there is an increasing population, which will be up in 1980.

(2) Higher motor efficiency (secured in part by higher compression and supercharging) which will give more miles per gallon of gasoline used.

(3) Change from gasoline to Diesel oils in trucks, tractors, and other heavy-duty machines.

(4) Increased production of natural gasoline and polymer gas.

(5) Recapture of the trade that previously used coal but is now using burning oils.

To offset such losses and cause an increasing use of crude petroleum and products, the following principal factors may be enumerated:

(1) Increasing population.

(2) Increase in cars per person and cars per family, that is, increasing carmindedness.

(3) Increasing speeds of automobiles due to better car and motor construction, and to the building of more and better roads and express highways. Increase in speed lowers miles obtained per gallon, ranging up to 25 and even 35 percent.

(4) Increased use of cars per year, that is, more miles driven per motor unit.

(5) Increasing use of oil in house burners.

(6) Increasing use of oil in Diesels both on land and water.

(7) Increasing consumption of motor fuels in airplanes.

(8) Increasing number of oil-burning ships.

Data are summarized to dispute the recent conclusion of the A.P.I. that petroleum consumption in the United States will reach a peak of 1,109,800,000 bbl. in 1950 and then decline. As against this the author figures a consumption of 1,447,000,000 bbl. in 1950 and 1,494,000,000 bbl. in 1960.

PRESENT POSITION OF POLYMER GASOLINE.—P. M. Robinson, before Penn. Mineral Industries Conf., April 1936. (Nat. Petrol. News, April 29, 1936.)

The author reviews the reasons why oil refiners are not showing greater alacrity in installing polymerization plants. Several factors are working to cause delay. First is the

depression, which has discouraged investment in new equipment not absolutely necessary. A second reason is that new developments, such as solvent extraction, new methods of dewaxing and of decolorizing, together with new specialties and synthetic materials, have diverted attention from gas polymerization. A third is that at the present time there is already an overproduction of gasoline, and that little would be gained by increasing the supply. A fourth reason is that Q grade ethyl gasoline has made it possible to produce cheaply a high octane gasoline with less cracking stock going into non-condensable gases.

However, there are certain reasons that pull in the opposite direction. One of these is the conservation of natural resources and the prevention of waste of raw material. There is no excuse for not making every possible effort to find some useful outlet for waste products. But considering the present fuel value of refinery waste gases and the cost of processing it is nevertheless apparent that there is little money to be made from polymer gasoline on a straight gallonage basis, particularly under Pennsylvania conditions. The real value of polymer gasoline lies in its high anti-knock qualities, and it appears that the only premium that can be granted polymer gasoline over conventionally refined gasoline is the possible saving of tetraethyl lead in blends. Blending anti-knock value will range from 80 to 125 octane number. By a combination of cracking, reforming of straight run, and gas polymerization, a motor gasoline of 70 octane number might be produced from Pennsylvania crude without any use of tetraethyl lead. More promising is the use of polymer gasoline alone for high output aviation engines. If the aviation industry continues to progress at the present rate it may consume all the polymer gasoline that can be produced; the prediction is made that a large amount of this material will be available in the near future.

General

LABORATORY BUBBLE-CAP COLUMNS OF GLASS—Johannes H. Bruun, before Am. Chem. Soc., Kansas City, April (1936).

This paper contains a description of two all-glass bubble-cap columns of a greatly improved design. These columns are exceedingly easy to operate and may be used for vapor velocities up to 1.0 and 2.2 ft. per second, respectively. Since the H.E.T.P. of one of these columns is about 2 cm., it is now feasible to build columns with separating powers equivalent to between 100 and 150 theoretical plates in a laboratory of average height.

AUTOIGNITION OF WILD WELLS.—W. Armstrong Price, in MINING AND METALLURGY, vol. 17 (1936), No. 353, pp. 240–242.

This is a summary of what is known or suspected about why gas wells take fire spontaneously. It is known that static electricity is generated in the presence of iron oxide and water and a flowing gas under high pressure.

The history of the gas well at White Point gives an undoubted example of the autoignition of hydrocarbon gas from a wild well by static electric discharge spontaneously produced. In the ignition of this well, water was introduced each time before ignition. When water was not introduced the well never once caught fire.

It is suggested that static electricity is probably a common cause of fires at wild oil and gas wells and that a little experimentation would show how to improvise conductors out of material at hand so as to discharge this electricity continuously and harmlessly until the flow of oil or gas could be shut off. If the danger of electric sparks be eliminated in future at wild oil and gas wells, we may then determine with what other causes of autoignition we may have to deal.

PETROLEUM POLYMERIZATION.—C. R. Wagner, before Penn. Nat. Gas Men's Assoc., April 24–25 (1936), (Nat. Petrol. News, Apr. 29, 1936).

At present there are three polymerization processes available to the public. The first here considered is the thermal process developed by the Phillips Petroleum Company which has a plant operating at Borger, Texas. It is understood that this plant is operating on a natural gas fraction consisting essentially of butanes, using pressures of 1,000 to 3,000 lbs. and temperatures of 950 deg. to 1,100 deg. F. The A.S.T.M. octane number of the product is 79.

In the process of the Universal Oil Company use is made of a catylist consisting of phosphoric anhydride, suitably supported in pellet form. The pressure used is 200 lbs. per sq. in., at temperatures of 400 deg. to 500 deg. F. The product consists almost entirely of olefins and is usually deficient in fractions boiling below 158 deg. F., but very little polymer heavier than gasoline is obtained, and the raw product can be hydrogenated to produce a very high octane fuel. Commercial quantities of crude iso-octane made in this manner are being offered by two major companies.

The process of the Pure Oil Company operates on a variety of gases between straight absorber exit and stabilizer reflux. The feed stock is prepared by concentrating the olefins by means of absorption and distillation under pressure. This stock is delivered as a liquid to the polymerization furnace where it is heated under pressure to the reaction temperature and passed into a reacting coil. A variety of products ranging from pure aromatics to a material resembling vapor-phase cracked-gasoline may be obtained. It is preferred, however, to crack paraffins in one stage and polymerize the olefins in a separate stage.

A very interesting fact observed in connection with the Pure Oil Company process is that aromatic hydrocarbons can be produced by polymerization of olefinic gases at much lower temperatures than by pyrolysis of paraffinic gases or gas oils. A gasoline of A.P.I. gravity 31 to 33 may be produced, which, after acid treating to remove diolefins, leaves a product from which practically pure benzene, toluene, xylene and naphthalene may be separated by fractionation. This opens the way to produce the aromatics heretofore obtained from coal tar.

It is claimed that it is possible to convert 90 percent or more of a paraffin gas, such as propane, into the corresponding olefin by means of a suitable dehydrogenation catalyst. With yields for the polymerization step varying from 75 to 90 percent it is easy to see what a tremendous force may be exerted on the fuel supply of the country and its cost to the public. "Conservative estimates" on the possible production of "poly" gasoline from refinery and natural gases indicate at least 4,500,000,000 gallons per year, which is more than 25 percent of the total gasoline consumption in the United States.

DEVELOPMENT AND HISTORY OF THE TANKSHIP.—B. Orchard Lisle, in JOUR. INST. PETROLEUM TECHNOLOGISTS, vol. 22 (1936), No. 149, pp. 118–139.

The author reviews the history of the oil tanker, which, it seems, was first invented by the Chinese in the 18th century, and the idea of shipping oil in bulk seems to have spread rather rapidly to Russia, Persia, and Burma. The first American representatives of this type of craft were the wooden oil barges that plied the Allegheny River. The first ocean-going tankers were iron sailing vessels, and it was not until 1872 that the first ship to be built as a tank-steamer, the *Vaderland*, made its appearance. Circumstances kept the *Vaderland* out of the oil business, and it remained for the *Zoroaster*, built in 1878, to be the first tank-steamer to see actual service.

From this point on the author traces the development of the marine transport of oil, noting the appearance of the various types of construction devised by the naval architects to meet the requirements of this kind of cargo. Numerous examples of both older and newer styles in tankers are interestingly described with pertinent comments on the problems that had to be faced and overcome.

The author notes that according to present figures 44 percent of the existing steam-tanker tonnage is over 15 years of age (the average life of a tanker), and 85 percent is over 10 years old. It is estimated that an annual production of 750,000 tons of tank vessels during the next five years will be necessary to meet requirements; most of the obsolete and unserviceable tanker tonnage appears to be owned by American firms. As regards the form which this new construction will take, it seems that the tanker with two or three longitudinal bulkheads will be favored; electrically-welded construction will be used to a far greater extent; streamlining will have more advocates and more vessels will be built for special-cargo purposes; hull construction will lean toward the Arc-Form and Mairer-Form for the sake of increased speed, greater carrying capacity and diminished daily fuel cost, with a tendency toward turbo-drive, Diesel-electric drive and, perhaps even more so, the extensive use of super-charging.

Beyond these matters is the question of service speed. At the present time Japan appears to be the only nation that is building fast special tankers for naval work or supporting owners who are willing to build such vessels; Japanese oil-carrying motor ships have established speed records of 18 to 20.5 knots, whereas present average speed is less than 13 knots. The Japanese 18-knot ships have been making 10 round trips where the conventional tanker makes 5 or 6, with consequent savings in operating costs and interest charges, not to mention the feature of more rapid delivery, which itself is worth money. In time of war the volume of slow tonnage which would have to be preempted for naval purposes might seriously cripple a country's industrial oil movements. If oil tankers are faster moving, not only will fewer vessels be needed, but they will be safer from enemy attack.

CANADA

ACCORDING to figures issued by the Dominion Bureau of Statistics at Ottawa, the Canadian production of crude petroleum amounted to 121,231 bbl. in January, 1936, as compared with 125,658 bbl. in the preceding month and 124,654 bbl. in January, 1935. Production from Alberta wells in January consisted of 101,368 bbl. of crude naphtha and 1,349 bbl. of light crude oil from the Turner Valley field, 1,300 bbl. of light crude oil from the Red Coulee field, 974 bbl. of heavy crude oil from the Wainwright field, and 180 bbl. of heavy crude oil from the Skiff field.

In January imports into Canada of petroleum, asphalt and their products amounted to a value of $2,373,426, compared with $2,255,859 during December, 1935. Receipts of crude petroleum during January came to 61,131,349 gallons, made up of 42,563,748 gallons from the United States, 11,606,891 gallons from Peru, 3,912,682 gallons from Colombia, and 3,048,028 gallons from Venezuela.

The Terminal well on the Del Bonita structure, Alberta, may prove a commercial crude oil producer. It is considered one of the wildest wells in Alberta and the gas pressure is very great. Efforts are to be made shortly to drill the well deeper. It blew in a few weeks ago and was out of control for several days, scattering oil over a wide area, until the gas flow subsided.

During 1935 Imperial Oil subsidiaries in the Turner Valley field produced 633,955 bbl. as compared with 717,501 bbl. in 1934. A new absorption plant was completed at the south end of the field and the ratio of recovered naphtha to gas output was increased. However, total output was reduced as the company's policy is to prolong the life of the field. At the close of 1935 the company controlled 82 oil and gas wells in western Canada.

The annual report of Mercury Oils Limited shows a net loss of $6,278 during the fiscal year ended December 31, 1935. It is reported that the company's No. 6 well, down to a depth of 2,800 ft., is favorably located.

Allowing for depletion and depreciation, Royalite Oil Company, Limited, showed a profit of $870,817 in 1935. Net profit, after paying of taxes, was $738,172. This company is a subsidiary of Imperial Oil Limited. Another subsidiary, The Foothills Oil & Gas Co. Limited, reported net profit of $16,056. Two other subsidiaries, the Southwest Petroleum Company and the Dalhousie Oil Company, however, both reported losses.

Gasoline Sales

SALES of gasoline in Canada during 1935 rose to 573,652,000 imperial gallons from the 1934 total of 534,782,000 imperial gallons. Imports of natural casinghead gasoline into Canada during 1935 totalled 48,417,345 imperial gallons as against 48,376,014 imperial gallons imported during 1934. Receipts of gasoline lighter than .8235 specific gravity at 60 deg. temperature advanced to 19,614,867 imperial gallons from the 1934 total of 13,205,856 imperial gallons. Exports of gasoline and naphtha from Canada in 1935 amounted to 3,357,902 imperial gallons; in the previous year 4,757,175 imperial gallons were exported.

Imports

IMPORTS of petroleum into Canada during March, 1936, were 65,383,199 gallons, valued at $2,090,522, compared with the February figure of 39,654,916 gallons valued at $1,185,468. The March, 1936, figures show a sharp rise of more than 20,000,000 gallons over March, 1935.

Gasoline imports during March were 917,936 gallons valued at $80,708, compared with 767,157 gallons for February, 1936, and 1,492,027 gallons during March, 1935.

MEXICO

THERE is a current feeling that some improvement may presently take place in the chaotic labor situation which has done more than anything else in the past few years to injure the country and labor itself by discouraging investment and development. Prompt action by President Lazaro Cardenas in suppressing the recent strike against the National Railways of Mexico and the definite assertion that the strike was illegally started has contributed in no small degree to this feeling.

Taken in connection with other recent occurrences, this is regarded as an indication that labor is to be held accountable to laws passed for its own protection. Friends of labor themselves admit that in numerous cases agitators have encouraged the making of unreasonable, and sometimes fantastic, demands which injure the cause of the workers as well as inflicting serious losses on their employers.

An indication of the greater disposition to require labor unions, as well as employing companies, to observe the terms of the law was afforded by the warning which the federal labor department issued to employes of the Mexican Eagle Company in the Nanchital fields, State of Vera Cruz. This statement pointed out that employes had no right to quit work unless they formally declared a strike in accordance with the labor laws, the regulations of which had been ignored in this particular case.

Another recent decision with a bearing on labor relations was that of the supreme court in granting an injunction to the Pierce Oil Company against enforcement of a ruling by a branch of the federal board of conciliation and arbitration in Merida, Yucatan. The company had been ordered to reinstate a clerk in its Merida office who had been dismissed, and to pay the wages of all employes for time lost during a suspension of work in connection with the dispute. The court held that the board had exceeded the authority assigned to it by the federal labor law.

Meanwhile the strike of field workers of Huasteca Petroleum Company, which has been going on for approximately four months, shows signs of approaching a settlement. As a result of protracted discussions between representatives of the unions and the company, in which members of the labor board also participated, it is stated that an agreement has been reached on all but three of the more than one hundred and fifty points originally in dispute. While the questions involved in these three points are not stated, it is hoped that with much the greater part of the issues in dispute successfully settled, negotiations will not fall through at this point.

Those who have talked with officials of the large companies operating here realize that these companies are genuinely anxious to improve the standard of living of their workers, as is instanced by the attention paid to health, sanitation and medical care, and the provision

Robert ("Bob") Galbreath needed the time and effort of a partner to develop his belief that oil existed on the Glenn farm. His efforts were in vain until he contrived to take Frank Chesley to the very spot. There, with a sledge borrowed from Bob Glenn, he proved the existence of oil. The partnership was struck — the famous Ida Glenn No. 1 was drilled — and the boom that followed established Tulsa as the oil center of the Southwest.

Skepticism that vanished with proof made possible the discovery of the famous Glenn Pool — one of the greatest fields in oil history. It is interesting to recall that, in 1932, when Dowell presented *Inhibited* Acidizing to the oil industry, it too was looked upon with skepticism. The successful treatment of more than 7,000 wells with an average increase in production of 421% is proof that Dowell methods and materials have transformed doubt into staunch acceptance.

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OIL AND GAS WELL CHEMICAL SERVICE

of improved housing for many of their workers. These officials produce figures to show that, in addition to such services provided, they pay higher wages than any other class of employers in the country. They recognize the right of the government to pass laws regulating the terms and conditions of employment but have been deeply concerned because these laws and the application of the regulations have gone far toward rendering successful operations impossible.

Part of the difficulty encountered by the companies has resulted from uncertainty as to the ultimate objectives of the government and as to the application of the laws. It has been difficult for the companies that are already paying high wages and granting large benefits to the employees, to understand why they should be the targets for continued unreasonable demands.

Technologists of the Ministry of National Economy are studying indications of petroleum found during the drilling of a water well on La Lima ranch, in the municipality of Tecuala, State of Nyarit, on the Pacific Coast. Should the investigation result in commercial production it will give Mexico a new oil zone, as there is no production at present in that area. The Ministry denies reports that a Tampico oil company has been granted a concession to exploit the deposit.

Another link in the system of improved highways has been added by completion of the new automobile road between Mexico City and Morelia, capital of Michoacan. The road connects with the Mexico City-Nuevo Laredo highway and ultimately will extend to Guadalajara, second largest city in the country, 625 miles west.

DOUGLAS GRAHAME

Conrad Schlumberger

IT is with deep regret that the recent death of Conrad Schlumberger, the noted French physicist, is announced. Mr. Schlumberger died on May 9 in Stockholm of a cerebral hemorrhage, after a very short illness, at the age of 58.

He was born in Guebwiller, Alsace, and successively attended in Paris the Ecole Polytechnique and the Ecole Nationale Superieure des Mines, from which he was graduated in 1904 as a State Mining Engineer (Corps des Mines). In 1906 he was appointed Professor of Physics at the School of Mines of St. Etienne, and in 1907 he received the same assignment at the Ecole Superieure des Mines in Paris, which he retained until the beginning of the World War. He gallantly took part in the whole World War as a Captain and Major in the French artillery. In 1919 he was reinstated Professor of Physics at the Ecole Superieure des Mines de Paris, which position he resigned in 1923 to devote himself entirely to activities in the field of Applied Geophysics.

It is for his research work, discoveries, and commercial success in this field that the name of Conrad Schlumberger is particularly known to the mining and geological profession at large. After several years of laboratory research work, he endeavored to apply his ideas and inventions to the solving of actual field problems of geology and tectonics. This practical phase was started in 1912, and as early as 1913 results of great economic value were achieved, such as the discovery of the Tilva Roch ore body on the properties of the Mines de Bor (Servia). In this respect he was indisputably a pioneer who laid the foundations of the then unknown art of applied geophysics.

After the war, Conrad Schlumberger and his associates, while remaining very active in the field of surface geophysical exploration, became interested in another phase of geophysical prospecting, namely the study of the nature of the formations traversed by a drill hole, by means of physical measurements actually performed at depth in the drill hole. The usefulness of this type of investigation was soon demonstrated, in particular in connection with oil exploration and exploitation. The service rendered to the oil industry in efficiency and in saving of time and money is considerable, and Conrad Schlumberger's invention ranks among the few outstanding ones achieved in the field of oil production during the past ten years.

The geophysical profession and the oil industry are incurring an irreparable loss in his passing.

▼

SHIPPING

INTEREST in the construction of tankships at the present moment is again focused on the policy of the big companies, the Anglo-Iranian Oil Company being in the market with a substantial order for no less than six 12,000 tonners on behalf of its subsidiary, the British Motor Tanker Company Ltd. Three of these ships will be built on the Clyde, two by Messrs. Harland & Wolff of Govan and one by Messrs. Lithgows Ltd., of Port Glasgow, all of which will have Harland B & W Diesels. Of the other three, two will be constructed on the Tyne and one at Birkenhead, these latter ships to have Doxford Diesels. New constructional policy would appear to indicate that the Anglo-Iranian Oil Company is not being so catholic in its taste for types of engines as has been the case in the past, the last two programmes having selected only the opposed piston Doxford 2-cycle, which has given them a great deal of satisfaction in the past, and the Harland B & W engine. Few details have been published concerning the new vessels but if the general plan arrangement published by Mr. H. S. Humphreys in a paper which he read recently before the Institute of Marine Engineers on THE CARE AND MAINTENANCE OF A MODERN DIESEL ENGINED TANKER FLEET is to be taken as any guide, then we find a vessel with standard proportions and a cruiser stern, the single screw operating in front of a streamlined rudder. Dimensions are 464.2 ft. b.p., 61.75 ft. beam moulded and 33.9 ft. depth moulded to the upper deck. The deadweight tonnage is 12,250 tons, gross tonnage being 8,060 tons and net tonnage 4,700 tons. There are nine oil cargo tanks made into triple tanks by two fore and aft bulkheads. Two pump rooms are arranged, one in the fore and the other in the aft group of tanks, between Nos. 2 and 3, and 6 and 7 holds respectively. This design shows the crew accommodated in the forecastle—rather an old-fashioned practice. Deck officers are amidships and no attempt is made to fall in with modern thought in the way of curving the forward end of the bridge. Engineers are quartered in and on the poop, and there is a small dry cargo hold forward with a further pump room on the port side arranged on a large fuel oil bunker forward, which is immediately abaft the aft peak. A further fuel oil bunker is arranged at the forward end of the machinery space. A midship section shown for vessels of dimensions corresponding to those for which the general arrangement plan is appended, shows longitudinal construction in the outer bottom and on the deck, and transverse framing at the sides, deep web frames being arranged in the way of the centre bulkhead. It is worth noting that the total value of orders for the last six tankers placed is over £9,000,000. The publication of this figure is considered important in Britain as giving a further indication to the public of the value of the work given even to the coal industry by the oil industry.

Socony-Vacuum is again in the market and has placed, through its Danish subsidiary, a 10,300 tonner with the Odense shipyard for delivery in March of next year. On the tramp side Mr. Martin Mosvold of Farsund has ordered two motor tankers of 15,000 tons each from Burmeister & Wain, for delivery between June and September of next year. These will be 13 knotters and the total price will be in the

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ANNUAL STATISTICAL REVIEW NUMBER

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neighbourhood of 5,800,000 Kr. The sale of two more Unilever contracts to Norwegian owners almost completes the disposal of this group of tonnage. These are 15,000 tonners and are due for delivery in the summer of next year, one having been sold to Sandifjord owners for £145,000 to replace an older ship passed on to Oslo owners.

Publication of new naval estimates for the British Admiralty is awaited by tanker builders as a possible indication of the fact that new fast craft may be constructed. It must be confessed, however, that at the present time there is little indication that the question of fast naval tanker building will be considered seriously. Apparently no one, as yet, plans to emulate the fast Japanese vessels—ships which are now, by the way, beginning to make their presence felt in Pacific cargo carrying, in other trades as well as in the oil business. This is due to the fact that when running light and trimmed by the stern they can carry silk across from Japanese ports to Pacific Coast ports at an 18-knot speed, a speed equal to that attained by many of the freighters operating at present and a speed superior to the majority of mail boats. This is certainly a very unusual application of tanker tonnage.

Though there has been marked activity in tanker building recently, the coastwise trade does not appear to have received its fair share. Certainly the number of coastal tankers under construction in Great Britain, compared with the number of cargo carriers, is extremely small.

Considerable activity is reflected in tankship tonnage now under construction according to the figures issued by Lloyds Register of Shipping for the quarter ended March of this year. There are now 76 tank vessels building with a total of 600,896 tons, of which no less than 67 are motor vessels of 537,071 tons, while only nine are steamers with 63,825 tons, and of these America contributes five with 35,300 tons. There is one 18,000 tonner under construction in Germany and two small ships of 6,245 tons (total) building in Holland, these being presumably for Lake Maracaibo service. The largest individual total of tanker tonnage at present being constructed is in Great Britain, for here there are 21 vessels of 160,670 tons, of which no less than 20 are motorships, of 156,390 tons, this figure being due to the orders placed by the Royal Dutch Shell and Anglo-Iranian groups. France is doing very little in tankship building at the moment, having only one vessel of 15,456 tons on the stocks, this being a large vessel of Sheherazade type for the Iraq pipeline work. The German situation, with vessels building for eventual transfer to Norwegian owners, is now well known and has caused no little comment in British shipowning circles. Fifteen tankers are building in that country with 130,100 gross tons. Japan's half dozen with 45,065 tons includes fast units for trans-Pacific work. Tankship building certainly is more satisfactory than it has been for some time and there is far more stability about it than for several years, this being due to the fact that the uncontrolled building of tramp tonnage, while not completely eradicated, is well in hand.

A. C. HARDY

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Official Figures for Soviet Oil Operations

1936	Crude Production (bbl.)	Daily Average (bbl.)	Runs to Stills (bbl.)	Drilling (feet)
January	16,500,000	532,290	14,000,000	513,700
February	15,400,000	531,435	13,600,000	460,000
March	15,940,000	514,200	13,860,000	580,000
April	15,100,000	503,305	13,600,000	610,000
Total 4 months 1936	62,940,000	520,165	55,060,000	2,163,700
Total 4 months 1935	54,299,000	469,747	43,280,300	1,475,451
Total 1935	176,688,100	497,713	146,705,100	4,868,465
Quota 1935	212,310,000	581,672	171,500,000	5,214,000
Quota 1936	213,500,000	581,178	175,000,000	7,100,000

Crude conversion: seven bbl.=one ton

ALTHOUGH the statistical showing of the Soviet oil industry for the month of April is slightly below plan, operations in the three main divisions (drilling, production and runs to stills) are running ahead of last year. Crude production for the first four months of this year has increased about 14 percent over production for the corresponding period of last year. Drilling operations have been expanded considerably, with noticeable improvements in distance drilled as well as in speed of drilling.

Flowing wells of considerable size were reported opened at various Soviet fields, including Grozni and Baku (Kala and Zikha fields). A terrific storm came in from the Caspian Sea during the beginning of April and raged over the Baku field for two days, seriously disrupting field operations. Many rigs were blown down and this naturally affected the statistical showing for the month. According to preliminary reports, crude production for all Soviet fields during April amounted to about 90 percent fulfillment of the quota, Baku leading with 95–96 percent fulfillment. The four individual oil field groups of Baku operated at the following rates of plan fulfillment for the month: Stalin fields, 102–103 percent; Lenin fields, 93–97 percent; Asisbekoff fields, 90–98 percent; Ordzonikidze fields, 86–93 percent. Thus far, Grozni fields have not been able to show any improvement, April operations ranging between 80 and 84 percent, while Maikop reached only 68–76 percent fulfillment.

Fields outside of the Caucasus were all behind plan and operated as follows: Emba, 82–90 percent (though during the last days of the month production improved considerably, on individual days attaining fulfillment 20–30 percent in excess of plan); Sakhalin, 91–95 percent (on individual days two and three percent above plan); Middleasia fields fluctuated considerably from 28 to 76 percent, as did the Bashkir fields (Ishimbayevo) which operated on individual days as low as 13 percent and as high as 76 percent. Ishimbayevo, however, is at present producing five times as much as it was this time last year. The Stakhanoff movement for speeding up operations has now been introduced at almost all Soviet oil fields, and a subsequent higher efficiency is anticipated.

Drilling operations during April revealed a striking improvement over March and the corresponding period of last year. Not only has substantial progress been made in speed of drilling as well as in distance drilled, but during April all-time records were attained at individual wells. On individual days drilling at Baku was 20 percent above quota, while at other Soviet fields records of between 25 and 125 percent above plan were reported. The season of the year, with its ideal weather conditions, has proved to be an effective ally to Soviet drillers by setting a favorable background for operations.

As a result of the Stakhanoff movement refinery operations have evidenced appreciable progress. According to reports for the first 21 days of April, one percent more gasoline and about 13 percent more kerosene was produced as compared with the first three weeks of March. Grozni refineries, although reporting some difficulty in obtaining sufficient crude from Baku, are operating above plan.

Preliminary work has started on the construction of a chemical combinate at Baku, some 35 kilometers (22 miles) from the city. The plant will utilize all pyrolese and cracking gases as raw material for chemicals. Actual construction will start in October, 1936, with a force of 2,500 men. S. Slutzki, head of the Baku oil industry, will be in charge of the work.

AVIAFUEL has selected a site near Moscow, on the Moskwa River, for the erection of a huge cracking combinate with an annual input capacity of 700,000 tons of mazout. At full capacity the installation is designed to produce some 200,000 tons of gasoline, 400,000 tons of boiler fuel and 90,000 tons of road asphalt.

DURING recent months, Soviet prospecting has resulted in several new discoveries of more than passing interest. Oil fields of commercial value, some of which have already disclosed flowing wells of considerable size, were dis-

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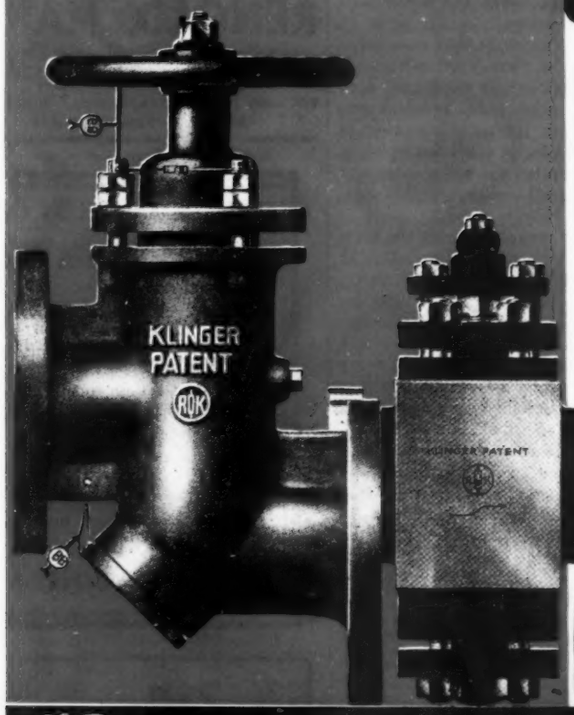

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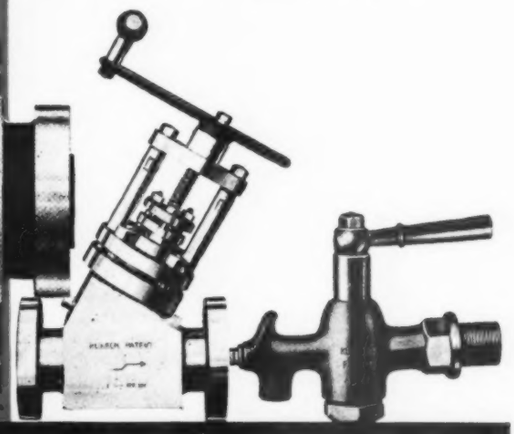

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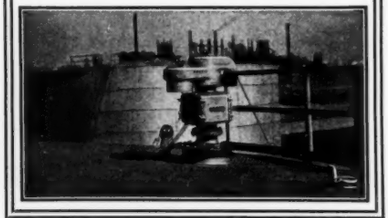

covered at Pirsagat (Baku), Izberbash (Grozni), Barsass (Kuznetzk coal basin) and Perm (Western Siberia). These discoveries are of such value and importance that they are likely to influence directly the Soviet's stated policy of a geographical redistribution of sources of supply within the next two or three years.

PIRSAGAT: This field is situated about 80 kilometers (50 miles) from Baku in a southwesterly direction and belongs to the Aliati group of the Prikurinsk Lowlands region. Prospecting at Pirsagat has been fraught with many difficulties since its development was initiated in 1931. The first two wells sunk reached oil-bearing sands at a depth of about 4,500 ft., but neither these two wells nor any others drilled in the field resulted in anything more tangible than the mere indication of the presence of oil and gas. Naturally, some of the drillers began to doubt the commercial value of such operations. In all, some 23 wells were drilled of which 10 were abandoned for technical reasons, four were completed, and at the others difficulties developed, such as cave-ins, gas-eruption under pressure, etc. Having encountered similar difficulties in drilling and prospecting at other Soviet fields, however, those in charge did not give up and persisted in their efforts to discover oil of commercial value.

Their labors were rewarded during the early part of April when prospecting well No. 27 came in, flowing 2,500 bbl. of crude daily. Within the next four days its flow was increased to about 4,000 bbl. per day. The importance of this well lies not so much in the fact that it has proved the commercial value of Pirsagat, as in the impetus it gives to further prospecting in the Aliati group and the adjacent territory of Prikurinsk—such as Babazanan, Durovdag, Duzdag and others, where up to the present, no deep drilling has been as yet attempted. In the extreme south of Prikurinsk the Neftechala field is already under commercial operation, indicating a likelihood of the entire area becoming an important group of oil fields. The value of these fields to the Soviets may equal that of the present combined Baku fields, and 30 new wells are to be drilled immediately.

IZBERBASH: This is one of three new prospecting areas in the Daghestan region. The other two fields are Achisu and Kayakent. These three fields are situated a distance of from 10 to 15 kilometers (six to nine miles) from one another on the shores of the Caspian Sea, not far from the Northern Caucasian railroad. They are about 40 kilometers (25 miles) from Makhatch Kala and about eight hours from Baku by rail. Kayakent, as well as some other locations, were under prospecting in prewar days, owing to the presence of visible signs of oil. Soviet operators were influenced by and followed these visible signs, but Soviet geolo-

Soviet Foreign Trade—Value in Rbl.

	Total Exports	Oil Exports	Imports
1929.....	923,700,000	138,000,000	880,632,000
1930.....	1,036,300,000	157,000,000	1,058,825,000
1931.....	811,200,000	115,000,000	1,105,000,000
1932.....	574,900,000	107,000,000	704,040,000
1933.....	494,900,000	75,000,000	348,216,000
1934.....	419,200,000	58,000,000	232,426,000
1935.....	367,411,000	42,500,000	241,374,000

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gists advised drilling at Achisu and Izberbash, though the presence of oil in these regions was not as obvious as at Kayakent. Since 1931 these two fields have been under close study, and, following deep drilling in 1933, about 250 hectares of oil lands were contoured. Of the three regions, however, Izberbash is the most promising field, judging from its geologic similarity to New Grozni.

During April prospecting well No. 8 started flowing 3,500 bbl. from a depth of about 5,400 ft., which corresponds to the depth of the sixteenth horizon in the October fields of New Grozni. (The sixteenth horizon has been worked for the past 50 years and has produced over 50 percent of the total Grozni production.) The crude from this well was a paraffin base, light grade of .834 gravity, containing approximately 30 percent gasoline, 5 percent ligroin and 24 percent kerosene; a total of 59 percent of light products. On the average, this is a higher quality than Grozni crude, and may be considered the best grade of Soviet crude.

The central and more elevated part of Izberbash is about 1½ kilometers (one mile) from the shore, where at depths of between 2,000 and 4,750 ft. about 18 layers of oil sand of approximately 1,000 ft. width were found. Below 5,000 ft. 12 more oil sand layers were discovered of 650 ft. width. New Grozni has but 22 layers of oil sand of about 1,000 ft. width. Development of the three fields is now proceeding with all possible speed, and it is expected that they will become commercial producers before the end of this year. The first shipments of Izberbash crude have already arrived at Grozni for processing.

All three Daghestan fields will require underwater drilling, such as is practiced in fields of the United States, Mexico and South America. Land and shore drilling is certain to encounter difficulties in the form of water seeping into wells, so it is fairly obvious that the Daghestan fields will entail a considerable outlay of time, effort and money. Eventually, however, they are almost certain to revive Grozni production, which has been on the decline since 1931 and has caused an acute shortage of Soviet gasoline.

At a recent conference of geologists at Grozni, the belief was expressed that the productive structures of Izberbash are situated under water, some distance from the shore, and that well No. 8 is still far from the actual deposits which are considerably higher than judged from this well. Well No. 6, now being drilled, is nearer to the shore and is expected to be more productive than the well just opened.

BARSASS: A prospecting well at Barsass, in the Kuznetzk coal basin, recently struck an oil strata considered of commercial value. A preliminary analysis indicates that the underground gases contain not less than 70 percent hydrocarbons, and it is generally believed that the actual deposits will prove to be of sufficient commercial value as to warrant further development.

At a geological conference at Novosibirsk, Prof. I. Gubkin strongly advised prospecting for oil in the Kuznetzk oil basin. Following this, G. Rabukhin assisted by other Soviet geologists, made a study of the Middle Devonian formations of the region. In April, 1935, Soviet geologist A. Tishnov, while prospecting for coal came upon strata filled with gas and some oil in liquid form. It was then decided to send an expedition to prospect for oil at Barsass. M. Barinov, head of Glavneft, became interested in this development and appropriated the necessary funds for prospecting. Mr. Barinov, who is at present on a visit to the United States, believes that Barsass will undoubtedly prove to be of commercial value and does not hesitate to predict that it will become an important source of oil for all Western Siberia. The belief that the saturation of the Barsass oil strata is of small value, he further states, has been completely disproved by the

Soviet Exports—Oil Products

(tons)

	Crude	Gasoline	Kerosene	Lubeoil	Gasoil	Fueloil	Total
1929	171.000	1.092.000	781.800	195.100	302.600	1.199.000	3.815.000
1930	235.600	1.470.100	775.500	211.000	423.300	1.612.400	4.803.000
1931	383.200	1.656.100	700.900	228.600	485.300	1.718.600	5.224.300
1932	525.900	2.017.600	828.800	187.200	627.000	1.870.000	6.106.000
1933	525.500	1.296.600	570.300	252.600	675.100	1.533.800	4.894.500
1934	458.519	1.119.950	436.500	305.320	565.530	1.385.900	4.315.000
1935	206.700	658.250	415.200	307.900	516.100	1.133.700	3.353.700

Soviet Exports vs. Internal Consumption

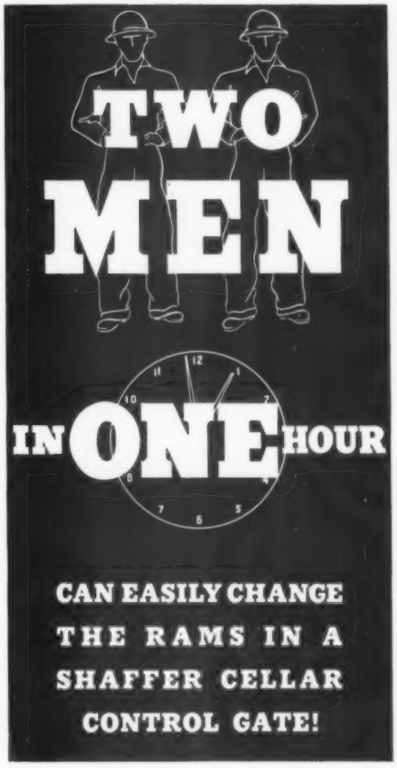
(tons)

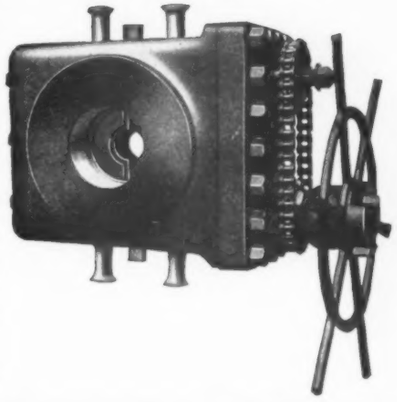
	EXPORTS			INTERNAL CONSUMPTION		
	Kerosene	Gasoline	Lubeoil	Kerosene	Gasoline	Lubeoil
1930	775.500	1.470.000	211.000	2.000.000	228.000	280.000
1931	700.000	1.656.100	228.600	2.150.000	400.000	480.000
1932	828.800	2.017.600	187.200	2.260.000	800.000	850.000
1933	570.300	1.296.600	252.600	2.330.000	1.095.000	1.020.000
1934	435.550	1.119.950	305.320	3.547.000	1.501.000	1.125.000
1935	416.200	658.200	307.900	4.000.000	1.650.000	1.150.000

Soviet Crude Production

Approximate Figures (in tons)

	1931	1932	1933	1934	1935	1936 Plan
Baku	12.000.000	15.500.000	16.500.000	18.000.000	20.000.000	22.000.000
Grozni	8.500.000	4.000.000	3.500.000	3.400.000	3.375.000	3.500.000
All others	1.500.000	1.800.000	2.000.000	2.100.000	2.625.000	5.000.000
Total	22.000.000	21.300.000	22.000.000	24.500.000	26.000.000	30.500.000

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fact that the few wells completed thus far show an average yield of 75 bbl. per day, which is much higher than originally anticipated.

PERM: At Krasnokamsk, during April, a well drilled to a depth of 3,150 ft. struck oil strata and started producing 85 bbl. under high gas pressure the first day. The crude is a light grade of .843 gravity and contains about 40 percent light products.

Prospecting for oil in this region has been carried on since 1934, when oil was accidentally discovered at 600 ft. while drilling for water. Soviet geologists advocated development and Glavneft ordered prospecting operations to be initiated.

Krasnokamsk is about 40 kilometers (25 miles) from the Chussoff villages along the Kama River and about 200 kilometers (124 miles) from Sterlitamak. Signs of oil have been found in various regions of the Ural mountains—Samarski Luka, Soka, Sheshma, Levshino—which are all related to the Chussoff villages and Ishimbayevo by a similarity of the Upper Paleozoic formations. All these places lie between the Ural mountains and the Volga River. Soviet geologists believe the Krasnokamsk oil fields will eventually be extended to include adjacent areas.

These new developments, together with the important discoveries at Emba and in the Urals, are of vital significance as concerns the Soviet objective of bringing sources of oil supply nearer to strategic points of consumption, and making all Soviet industrial centers less dependent upon oil supplies from the Caucasus. It is not unlikely that the development of the new regions will take time. Difficulties will be encountered, owing to lack of roads, equipment, supplies and transportation facilities, but these can all be overcome.

The Emba fields contain adequate supplies for the development of a base capable of producing millions of barrels of crude, with the industrial centers in the east (Orsk) as their outlet. The Ishimbayevo fields, together with the new discovery at Krasnokamsk on the Kama River, are certain to yield ample supplies for their natural outlet—the Volga plains and thence down to Moscow. The Barsass discovery, when sufficiently developed, will become the source of supply for the Kuznetzk coal basin and the growing industrial centers of Western Siberia. Sakhalin is increasing production and, in conjunction with the refinery at Khabarovsk, will form a vital source of oil supplies for the Soviet Far East.

The new discoveries of Izberbash, Achisu and Kayakent in the Daghestan region, with operations controlled by Grozni, may effect the rejuvenation of Grozni within the near future. These fields are near the sea and have rail connections with Baku in the south and Grozni in the west, enabling them to obtain necessary equipment and supplies from the well-established oil centers of the Caucasus. Soviet commissions, headed by M. Barinov, on their current visit to the United States will undoubtedly place orders for equipment in order to facilitate the immediate development of these fields, which contain a light crude rich in gasoline content.

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